CHINA RAILWAY DESIGN CORPORATION
Косте Рацина 16б, 11000 Београд
САОБРАЋАЈНИ ИНСТИТУТ ЦИП д.о.о

2/1.1.12.1 НАСЛОВНА СТРАНА

2/1. ПРОЈЕКАТ КОНСТРУКЦИЈА

Инвеститор:	„Инфраструктура Железнице Србије“ а.д. Немањина 6/4, Београд
Наручилац:	Конзорцијум фирми: China Railway International Corporation Ltd. China Communication Construction Company Ltd. (CCCC)
Објекат:	Пруга Београд - Суботица државна граница (Келебија), **ДЕОНИЦА ПРУГЕ НОВИ САД - СУБОТИЦА - ДРЖАВНА ГРАНИЦА (КЕЛЕБИЈА),** у Новом Саду, Кисачу, Степановићеву, Змајеву, Врбасу, Ловћенцу, Малом Иђошу, Бачкој Тополи, Жеднику, Наумовићеву и Суботици, К.О. Нови Сад I, К.О. Нови Сад IV, К.О. Кисач, К.О. Руменка, К.О. Степановићево, К.О. Ченеј, К.О. Бачко Добро Поље, К.О. Врбас, К.О. Врбас - град, К.О. Змајево, К.О. Куцура, К.О. Ловћенац, К.О. Мали Иђош, К.О. Фекетић, К.О. Бачка Топола, К.О. Бачка Топола - Град, К.О. Мали Београд, К.О. Биково, К.О. Доњи Град, К.О. Жедник, К.О. Нови Град, К.О. Палић, К.О. Стари Град, на катастарским парцелама према списку приложеном у Главној свесци
Врста техничке документације:	**ПГД-** Пројекат за грађевинску дозволу
Назив и ознака дела пројекта:	**ПРОЈЕКАТ КОНСТРУКЦИЈА -** **2/1.1.12 Пројекат надвожњака на км 95+739.56**
За грађење / извођење радова:	Нова градња
Пројектант:	China Railway Design Corporation Serbia Ogranak Beograd Косте Рацина 16б 11000 Београд, Србија
Одговорно лице пројектанта:	Генерални директор: 耿欣 (Генг Ксин)
Потпис:	XIN GENG Digitally signed by XIN GENG Date: 2021.08.03 09:17:54 +02'00'
Одговорни пројектант:	Зоран Луковић, дипл. грађ. инж. Лиценца број: 310 3032 03
Потпис:	ЗОРАН ЛУКОВИЋ 011041396 Auth Digitally signed by ЗОРАН ЛУКОВИЋ 011041396 Auth Date: 2021.07.30 09:10:43 +02'00'
Број дела пројекта:	2020-001-ГС-2/1.1.12
Место и датум:	Београд, април 2021.год.

CeS.TRA

ТЕХНИЧКА КОНТРОЛА ПРОЈЕКТА ЗА ГРАЂЕВИНСКУ ДОЗВОЛУ

2/1-1.12 ПРОЈЕКАТ НАДВОЖЊАКА НА КМ 95+739.56

Објекта: Пруга Београд - Суботица - државна граница (Келебија), **ДЕОНИЦА ПРУГЕ НОВИ САД - СУБОТИЦА - ДРЖАВНА ГРАНИЦА (КЕЛЕБИЈА)**, у Новом Саду, Кисачу, Степановићеву, Змајеву, Врбасу, Ловћенцу, Малом Иђошу, Бачкој Тополи, Жеднику, Наумовићеву и Суботици, К.О. Нови Сад I, К.О. Нови Сад IV, К.О. Кисач, К.О. Руменка, К.О. Степановићево, К.О. Ченеј, К.О. Бачко Добро Поље, К.О. Врбас, К.О. Врбас - град, К.О. Змајево, К.О. Куцура, К.О. Ловћенац, К.О. Мали Иђош, К.О. Фекетић, К.О. Бачка Топола, К.О. Бачка Топола - Град, К.О. Мали Београд, К.О. Биково, К.О. Доњи Град, К.О. Жедник, К.О. Нови Град, К.О. Палић, К.О. Стари Град, на катастарским парцелама према списку приложеном у Главној свесци, на основу Закона о планирању и изградњи („Службени гласник РС” бр. 72/09, 81/09 – исправка, 64/10 – одлука УС, 24/11, 121/12, 42/13 – одлука УС, 50/13 – одлука УС, 98/13 – одлука УС, 132/14, 145/14, 83/18, 31/19, 37/19 - др. Закон, 9/20 и 52/21) и одредби Правилника о садржини, начину и поступку израде и начину вршења контроле техничке документације према класи и намени објеката (“Службени гласник РС”, бр. 73/2019), извршена је техничка контрола предметне документације, од стране предузећа CESTRA d.o.o. Београд.

ПРОЈЕКАТ СЕ ПРИХВАТА

Вршилац техничке контроле: CESTRA d.o.o,
Макензијева 57, Београд

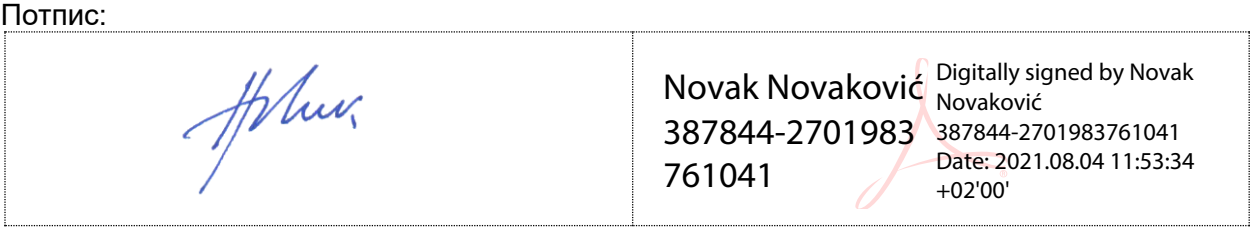
Број лиценце: 351-02-03374/2020-09 од 18.03.2021.

Одговорно лице/Заступник: Директор:
Драган Милић, дипл.грађ.инж.

Потпис:

Вршилац техничке контроле: Драган Милић, дипл.грађ.инж.
Број лиценце: 312 E503 07
Потпис:

Вршилац техничке контроле: Новак Новаковић, дипл.грађ.инж.
Број лиценце: 310 K201 11
Потпис:



Број техничке документације: A10312-61/21

Место и датум: Београд, 2021.

2/1.1.12.2. САДРЖАЈ

2/1.1.12.1	Насловна страна	
2/1.1.12.2	Садржај	
2/1.1.12.3	Решење о одређивању одговорног пројектанта	
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Цртежи	Назив цртежа	Размера
2020-001-ГС-2/1.1.12.7-Ц01	Основа, уздужни пресек, изглед	1:200
2020-001-ГС-2/1.1.12.7-Ц02	Карактеристични попречни пресек	1:50
2020-001-ГС-2/1.1.12.7-Ц03	Попречни пресеци	1.100

2/1.1.12.3 РЕШЕЊЕ О ОДРЕЂИВАЊУ ОДГОВОРНОГ ПРОЈЕКТАНТА

На основу Члана 128, Закона о планирању и изградњи ("Службени гласник РС", бр. 72/09, 81/09-исправка, 64/10- одлука УС, 24/11, 121/12, 42/13-одлука УС, 50/13-одлука УС, 98/13-одлука УС, 132/14, 145/14, 83/2018, 31/2019, 37/2019 - др.закон и 9/2020) и одредби Правилника о садржини, начину и поступку израде и начину вршења контроле техничке документације према класи и намени објеката ("Службени гласник РС", бр. 73/2019) као:

О Д Г О В О Р Н И П Р О Ј Е К Т А Н Т

за израду **ПРОЈЕКТА КОНСТРУКЦИЈА - 2/1.1.12 Пројекат надвожњака на км 95+739.56**, који је део ПГД - Пројекта за грађевинску дозволу за изградњу пруге Београд - Суботица државна граница (Келебија), **ДЕОНИЦА ПРУГЕ НОВИ САД - СУБОТИЦА - ДРЖАВНА ГРАНИЦА (КЕЛЕБИЈА)**, у Новом Саду, Кисачу, Степановићеву, Змајеву, Врбасу, Ловћенцу, Малом Иђошу, Бачкој Тополи, Жеднику, Наумовићеву и Суботици, К.О. Нови Сад I, К.О. Нови Сад IV, К.О. Кисач, К.О. Руменка, К.О. Степановићево, К.О. Ченеј, К.О. Бачко Добро Поље, К.О. Врбас, К.О. Врбас - град, К.О. Змајево, К.О. Куцура, К.О. Ловћенац, К.О. Мали Иђош, К.О. Фекетић, К.О. Бачка Топола, К.О. Бачка Топола - Град, К.О. Мали Београд, К.О. Биково, К.О. Доњи Град, К.О. Жедник, К.О. Нови Град, К.О. Палић, К.О. Стари Град, на катастарским парцелама према списку приложеном у Главној свесци, одређује се:

Зоран Луковић, дипл.грађ.инж. _____310 3032 03

Пројектант:	CHINA RAILWAY DESIGN CORPORATION SERBIA OGRANAK BEOGRAD, Косте Рацина 16б
Одговорно лице/заступник:	Генерални директор: Генг Ксин, дипл.инж.
	Потпис:
Број техничке документације:	2020-001-ГС-2/1.1.12
Место и датум:	Београд, април 2021.год.

2/1.1.12.4 ИЗЈАВА ОДГОВОРНОГ ПРОЈЕКТАНТА

Одговорни пројектант пројекта **ПРОЈЕКТА КОНСТРУКЦИЈА - 2/1.1.12 Пројекат надвожњака на км 95+739.56** који је део ПГД - Пројекта за грађевинску дозволу за изградњу пруге Београд - Суботица државна граница (Келебија), **ДЕОНИЦА ПРУГЕ НОВИ САД - СУБОТИЦА - ДРЖАВНА ГРАНИЦА (КЕЛЕБИЈА)**, у Новом Саду, Кисачу, Степановићеву, Змајеву, Врбасу, Ловћенцу, Малом Иђошу, Бачкој Тополи, Жеднику, Наумовићеву и Суботици, К.О. Нови Сад I, К.О. Нови Сад IV, К.О. Кисач, К.О. Руменка, К.О. Степановићево, К.О. Ченеј, К.О. Бачко Добро Поље, К.О. Врбас, К.О. Врбас - град, К.О. Змајево, К.О. Куцура, К.О. Ловћенац, К.О. Мали Иђош, К.О. Фекетић, К.О. Бачка Топола, К.О. Бачка Топола - Град, К.О. Мали Београд, К.О. Биково, К.О. Доњи Град, К.О. Жедник, К.О. Нови Град, К.О. Палић, К.О. Стари Град, на катастарским парцелама према списку приложеном у Главној свесци:

Зоран Луковић, дипл. грађ.инж.

И З Ј А В Љ У Ј Е М

1. да је пројекат у свему у складу са издатим Локацијским условима:

-бр.ROP-MSGI-28188-LOCH-4/2020, Заводни број: 350-02-00031/2020-14 од 06.04.2020,

-бр.ROP-MSGI-28188-LOCH-4/2020, Заводни број: 350-02-00031/2020-14 од 07.04.2020 - Решење о исправци грешке,

-бр.ROP-MSGI-7141-LOC-1/2020, Заводни број: 350-02-00109/2020-14 од 08.05.2020,

-бр.ROP-MSGI-931-LOC-3/2020, Заводни број: 350-02-00192/2020-14 од 29.05.2020;

2. да је пројекат израђен у складу са Законом о планирању и изградњи, прописима, стандардима и нормативима из области изградње објеката и правилима струке;

3. да је пројекат у свему у складу са начинима за обезбеђење испуњења основних захтева за објекат прописаних елаборатима и студијама.

Одговорни пројектант:	Зоран Луковић, дипл. грађ. инж.
Број лиценце:	310 3032 03
	Потпис:
Број техничке документације:	2020-001-ГС-2/1.1.12
Место и датум:	Београд, април 2021.год.

2/1-1.12.5 ТЕКСТУАЛНА ДОКУМЕНТАЦИЈА

2/1-1.12.5.1 ТЕХНИЧКИ ОПИС

ТЕХНИЧКИ ОПИС

1. УВОД

Деоница пруге Нови Сад-Суботица-државна граница (Келебија) представља трећу деоницу пруге Београд-Суботица-државна граница (Келебија).

На новој траси двоколосечне пруге Нови Сад - Суботица (мађарска граница), пројектованој за брзину од 200 км/х, уместо постојећег путног прелаза у нивоу, пројектован је нови друмски надвожњак на стационажи пруге км 95+739,56 десног колосека.

2. САОБРАЋАЈНИ УСЛОВИ

Надвожњак је предвиђен за двосмерни саобраћај где сваки смер има по једну коловозну траку ширине 3.0м и једну службену стазу. На делу објекта, осовина пута је у правцу. Пешачке (сервисне) стазе су ширине 1.70м. Попречни нагиб пешачких стаза је ка коловозу и износи 4%. Укупна ширина објекта је 9.40м. Нивелета моста је у средишњем делу у вертикалној кривини од 400м, а ка крајевима објекта у константном подужном нагибу од 6%. Попречни пад коловоза износи 2,5%.

Укрштање левог колосека пруге и надвожњака је на стационажи км. 95+739,56, Под углом од 93°34’.

3. ДИСПОЗИЦИЈА МОСТА

Надвожњак се уклапа у геометрију пута и прелази преко двоколосечне пруге под углом од 93°34’, што је диктирало положај и оријентацију стубова, као и распоне објекта.

Састоји се од седам поља, осовинских распона од 16.65+5x23.20+16.65м, укупне дужине 149.30м.

Надвожњак је армирано бетонска и преднапрегнута полу интегрална конструкција са полумонтажним начином градње распонске конструкције. Таквим начином градње омогућена је градња без високих и компликованих скела. Избегнуто је бетонирање већег дела распонске конструкције на лицу места, а истовремено постигнута монолитна веза средњих стубова и распонског склопа, чиме је избегнут значајан број лежишта. Такав концепт чини конструкцију поузданијом и једноставнијом за одржавање.

Карактеристични попречни пресек надвожњака

Укупна ширина распонске конструкције је 9.40 м и састоји се од:

• Размак од ограде до спољње ивице	2 x 0.25 = 0.50 м
• Сервисна стаза	2 x 0.75 = 1.50 м
• Еластистична одбојна ограда	2 x 0.50 = 1.00 м
• Сигурносни простор до ограде	2 x 0.20 = 0.40 м
• Коловоз	2 x 3.00 = 6.00 м
Укупно:	9.40 м

4. ОПИС КОНСТРУКЦИЈЕ

Конструктивни елементи

Надвожњак је армирано бетонска и преднапрегнута конструкција са полумонтажним начином градње распонске конструкције. Таквим начином градње омогућена је градња без високих и компликованих скела, у реци ризичних при појави великих вода, а над пругом и путем не ометају железнички и путни саобраћај. Избегнуто је бетонирање већег дела распонске конструкције на лицу места, а истовремено постигнута монолитна веза средњих стубова и распонског склопа.

Попречни пресек распонске конструкције чини 10 монтажних преднапрегнутих ”И” носача висине 0.90м, спојених армирано бетонском плочом дебљине 20-28 цм и попречним носачима над ослонцима, ливеним на лицу места, чиме се постиже целовитост распонске конструкције.

Висина монтажних носача одређена је према највећем распону, а из конструктивних и естетских разлога иста висина је усвојена и за остале распоне. Осовински размак између монтажних носача је 0.90м.

Монтажни носачи се ослањају на лежишну греду која горњом ивицом прати попречни нагиб коловоза од 2.50%, док је доња ивица лежишних греда хоризонтална. Ширина лежишне греде је 1.20м, док је висина промењива.

Над обалним стубовима су предвиђена по два лончаста лежишта, померљива у подужном правцу.

Потпорна конструкција

Средњи стубови се састоје од два правоугаона стуба дебљине 80цм и ширине 160цм, на међусобном размаку од 4.10м. Ослањање средњих стубова је извршено преко темељне греде димензија 1.80м x 1.80м, дужине 9.20м.

Обални стубови су са пропуштеним насипом. Састоје се од парапета, лежишне греде и три кружна стуба дебљине Ф100цм, висине 4.00м и на међусобном размаку од 3.60м. Ослањање кружних стубова је извршено преко темељне плоче дебљине 1.50м.

На оба обална стуба су прикључене прелазне плоче дебљине 25 цм и типске дужине 3,70+2.50 = 6.20 м.

Фундирање

Обзиром на геолошки састав и носивост тла, на присуство подземне воде, а у сагласности са геолошко геотехничким елаборатом, извршено је дубоко фундирање, а усвојену коту фундирања шипова треба да потврди геотехничар приликом ископа. Усвојено је фундирање на бушеним шиповима Ø120 цм.

Фундирање је предвиђено на шиповима дужине 15 и 16 м.

На средњим стубовима предвиђена су три шипа у једном реду на међусобном размаку од 3.60м.

На обалним стубовима предвиђеноје три шипа у два реда, што чини укупно шест шипова испод сваког обалног стуба. Шипови су на размаку од 3.0м у правцу осе моста, односно 3.60 м у управном правцу.

Обзиром на састав тла, шипови ће носити и по бази и по омотачу. Дубина и број шипова је димензионисан тако да максимална сила у шипу буде мања од срачунате носивости шипа.

Испод темељних греда и плоча је предвиђен слој за изравнање од 10 цм, од неармираног бетона C12/15.

Наглавне греде шипова и темељи се затрпавају водонепропусним материјалом, а клин иза крајњих стубова се изводи од шљунковите мешавине, погодне за дренирање подземне воде, набијањем у слојевима од по 30 цм.

Распонска конструкција

Распонска конструкција моста је монолитна и настала је спрезањем 7 x 10 = 70 монтажних ”И” носача висине 90цм са армирано бетонском плочом и попречним носачима, ливеним на лицу места. За цео мост су коришћене две дужине монтажних носача – 22.80 м и 16.55 м.

Ширина горње и доње фланше монтажног ”И” носача је 50цм, ширина ребра је 22 цм, док је висина носача 0.90 м. Армирано бетонска коловозна плоча дебљине 20-28 цм и прати закривљеност, подужни и попречни нагиб пута.

Делови површине монтажних носача који долазе у додир са бетоном ливеним на лицу места морају се обрадити ситним штоковањем или на други начин обезбедити храпављење. Ово се односи и на везу са бетоном коловозне плоче и на везу са попречним носачима.

Предвиђено је преднапрезање монтажних ”И” носача, са кабловима 3x6Ø15.7мм за веће, односно 2x6Ø15.7мм за мање носаче, са ниском релаксацијом.

Статички систем

У подужном смислу надвожњак је оквирна конструкција на седам распона, 16.65м + 5x23.20м + 16.65м = 149.30м. Као систем простих греда монтажни носачи примају оптерећење од сопствене тежине и бетона коловозне плоче, ливених на лицу места. Спрегнути континуални носач прима додатна оптерећења од накнадно нанетог сталног терета асфалата и хидроизолације, бетона пешачких стаза, ограда итд., као и саобраћајног и температурног оптерећења. Затежуће силе настале од момената од овог оптерећења у горњој зони над ослонцима прима подужна мека арматура у коловозној плочи. Носачи су проверени за све фазе експлоатације и за све старости бетона које се могу јавити, почев преднапрезања преко ослобађања од оплате и одизања у производном погону, преко транспорта и монтаже на лицу места, до свих фаза градње и експлоатације моста. Хоризонталне силе од сеизмике, силе кочења, температуре, скупљања и течења у правцу подужне осе моста примају сви средњи стубови, док хоризонталне силе од сеизмике и ветра у попречном правцу примају и обални стубови.

Елементи коловоза

На припремљену бетонску површину, која је претходно очишћена пескарењем и отпрашивањем путем компресора, наноси се хидроизолација. Преко хидроизолације се наноси коловозни застор.

Коловозна конструкција се састоји из два слоја асфалта. Први, заштитни слој дебљине 3.0цм, је асфалтбетон АБ 11С, други хабајући, је асфалтбетон СМА 0/11 дебљине 4.0цм.

Ивичњаци су димензија 20 x 25 цм, висине изнад коловоза 10цм. Ивичњаци се до 0 цм на делу рампи висински прилагођавају попречном профилу трасе аутопута.

Службена стаза је армирано-бетонска, са храпавом горњом површином. Од дејства мраза и соли штити се вишеструким заштитним премазом, отпорним на УВ зраке, са могућностима премошћавања пукотина и на температурама испод 0°Ц, отпорним на дифузију $ЦО_2$, водонепропусним, високе отпорности на старење и високе отпорности на хабање и хемијски агресивне утицаје.

Све бетонске површине у додиру са земљом премазују се са два битуменска премаза.

Опрема

Пројектом су предвиђене еластомерне дилатације над обалним стубовима капацитета померања ± 80мм.

Над обалним стубовима предиђена су по два лончаста лежишта, подужно померљива.

Еластична одбојна ограда треба да задовољи одредбе прописа EN 1317. На мосту је предвиђена пешачка заштитна ограда са округлим профилима и вертикалном испуном, од поцинкованог челика, висине 110 цм и окцима ширине мање од 12 цм.

На централном распону, изнад пруге, предвиђена је заштитна мрежа.

За пролаз комуналних и других евентуалних водова предвиђене су ПВЦ цеви одговарајућег пречника, које су уграђене у бетон сервисних стаза, а предвиђени су и ревизиони шахтови са челичним поклопцем који служе за контролу инсталација које су уграђене у сервисне стазе.

Сливници на мосту су цевима повезани у затворени систем за одводњавање и испуштају атмосферску воду у кишну канализацију којом иду у систем за пречишћавање. Сливник мора да има одтицајно корито преко кога је могуће наставити хидроизолацију и усмерити процедну воду у сливник.

Бетонске прилазне рампе просечне дебљине 25 цм су армиране конструктивно и обликом се прилагођавају промени висине ивичњака и положају каналета.

Материјали

Пројектом је предвиђено уграђивање бетона следећих карактеристика:

Преднапрегнути носач	C45/55
Коловозна плоча	C35/45
Средњи стубови	C30/37
Крајњи стубови и крилни зидови	C30/37
Шипови	C30/37
Темељне стопе и наглавне греде	C30/37
Прелазне плоче	C30/37

Бетони отпорни на мраз и со морају бити припремљени са одговарајућим системом увучених ваздушних пора (додатак аеранта), ниским водоцементним фактором (са суперпластификатором на бази поликарбоксилата), агрегатом ниске потребе за водом и коефицијентом термичке дилатације компатибилном КТД-у цементног камена, правилно уграђени и неговани, са што већим процентом довршене хидратације пре излагања смрзавању. Речни агрегат са претежно кварцним минералима има коефицијент термичке дилатације приближан КТД-у цементне масе. Бетон носача не сме имати састојке који поспешују корозију ужади за преднапрезање.

Армирање се изводи арматуром B500B, док се преднапрезање изводи ужадима пречника Ø15.7мм, квалитета 1670/1860 MPa са ниском релаксацијом (мах 2,5% након 1000 х).

Квалитет уграђеног материјала мора одговарати важећим стандардима и пре уграђивања морају се приложити докази о квалитету материјала, без којих не сме почети уградња.

5. ТЕХНОЛОГИЈА ГРАДЊЕ

Ископ за темеље стубова и наглавне греде шипова се изводи плитко, машинским ископом темељних јама без посебне заштите. За извођење бушених шипова на осталим стубовима треба обезбедити приступ гарнитуре за бушење. Шипови се бетонирају до нивоа од мин 30 цм изнад врха шипа, с тим да на првом изведеном шипу надвишење буде мин 60 цм. При крајцовању “запрљаног“ бетона чувати постављену арматуру.

После постављања слоја подложног бетона, арматуре и оплате, изводе се темељи, наглавне греде шипова и стубови, бетоном ливеним на лицу места уз потребну оплату. После ове фазе могуће је приступити делимичном затрпавању темеља и изради кегли, дренажа и засипа иза крајњих стубова.

Израда монтажних елемената распонске конструкције је у фабрици монтажних елемената. Њихова испорука на градилиште је могућа специјалним камионима. За њихову монтажу може се користити ауто-дизалица или лансирна решетка. Носачи се постављају директно на лежишне греде преко слоја изравнавајућег малтера, дебљине цца 30мм, прилагођеног подужном нагибу моста. После монтираних главних носача поставља се арматура и одговарајућа оплата и бетонирају попречни носачи и плоча, мада је могуће и фазно бетонирање.

На потпуно суви и неиспрскали бетон плоче поставља се прајмер и хидроизолација. Потребно је заштитити хидроизолацију моста пре других радова. По постављању

ивичњака се бетонирају службене стазе и ивични венци. Следе радови на асфалтирању, постављању ограда и евентуалних инсталација.

6. ИЗМЕНЕ У ОДНОСУ НА ИДЕЈНИ ПРОЈЕКАТ

Концепт моста је задржан као у Идејном пројекту уз одређене ситне измене у циљу усаглашавања пројекта са технологијом извођача, као и оптимизације решења. Задржан је монтажни систем градње уз следеће измене :

1. Уместо атхезионог примењено је накнадно преднапрезање.
2. Услед измене под тачком 1 подебљано је ребро са 15 цм на 22 цм како би накнадно преднапрезање било изводљиво.
3. Редукована је марка бетона са C50/60 на C45/55
4. Повећан је број крутих веза између стубова и распонске конструкције

На овај начин пројекат је усаглашен са технологијом извођача и при томе добијена поузданија конструкција једноставнија за одржавање.

Београд, април 2021.

Зоран Луковић, дипл. грађ. инж.
лиценца бр.: 310 3032 03

2/1-1.12.6 НУМЕРИЧКА ДОКУМЕНТАЦИЈА

2/1-1.12.6.1 СТАТИЧКИ ПРОРАЧУН

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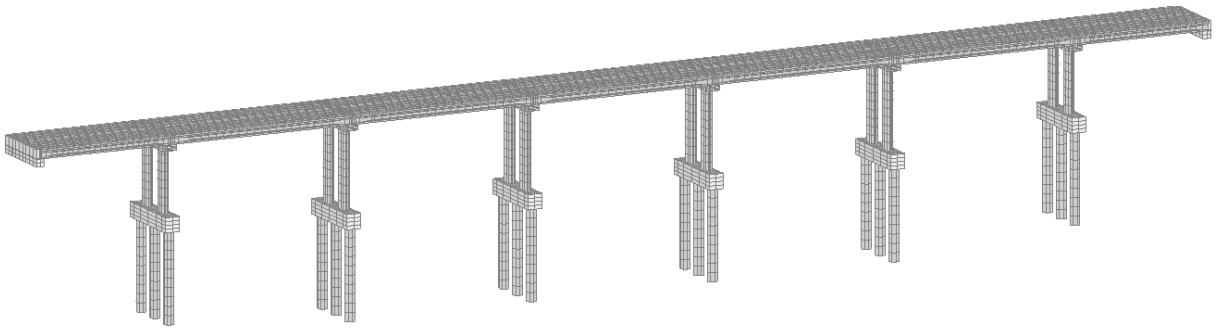
1. УВОД

INTRODUCTION

1. **УВОД** / INTRODUCTION

Распонска конструкција састоји се из композитног пресека којег чине десет монтажних носача "I" попречног пресека континуираних плочом ливеном на лицу места. Монтажни носачи се накнадно утежу. Распонска конструкција је преко седам поља, осовинских распона: 16.65 + 23.2x5 + 16.65 = 149.30 m. Статички систем моста је континуални носач са крутим везама на свим средњим стубовима, и лежиштима на обалним стубовима. Попречни пресек главног носача је укупне ширине 9.40 m и висине 1.10 m.

The superstructure consists of a composite cross-section made up of precast, pre-tensioned I-girders with a cast-in-place slab. There are a total of five spans, measuring 16.65 + 23.2x5 + 16.65 = 149.30 m. Following composite action, the girders become continuous over the piers, with rigid connections at each support at middle piers, and with bearings on the abutments. The total width of the superstructure cross-section is 9.40m and total height of 1.10 m.



Статички модел и анализа конструкције је урађена са програмским пакетом RM Bridge Advanced V10, тако што су главни носачи и плоча у подужном смеру моделирани уз следеће елементе: beam (штапови), tendon (каблови), spring elements (везе). При томе су уважаване фазе грађења. Елементи су подељени у групе које се активирају према фази изградње. Привремена лежишта су представљена опругама посебне групе и одговарајуће крутости.

The structure was analyzed using RM Bridge Advanced V10; finite element modeling software specialized for the design of bridges. In the longitudinal direction, the precast girder and cast-in-place slab were modeled in combination with beam elements (frames), tendons (cables) and spring elements (connections). Construction staging was taken into account as part of the modeling process: structural elements were divided into groups that were activated in accordance with their specific construction phase (e.g. being able to obtain and compare results before and after composite action). Temporary supports (bearings) were modeled as springs, with an assigned rigidity and grouped accordingly.

Нумерација елемената за прорачунски модел / Numeration of elements for calculation model

Монтажни носач, плоча и композитни пресек /
Main Girder, slab, composite section

Span 01	girder		slab		comp	
span01.01	10101	10127	20101	20127	101	127
span01.02	10801	10827	20801	20827	801	827
span01.03	11501	11527	21501	21527	1501	1527
span01.04	12201	12227	22201	22227	2201	2227
span01.05	12901	12927	22901	22927	2901	2927
span01.06	13601	13627	23601	23627	3601	3627
span01.07	14301	14327	24301	24327	4301	4327
span01.08	15001	15027	25001	25027	5001	5027
span01.09	15701	15727	25701	25727	5701	5727
span01.10	16401	16427	26401	26427	6401	6427

Span 02	girder		slab		comp	
span02.01	10201	10228	20201	20228	201	228
span02.02	10901	10928	20901	20928	901	928
span02.03	11601	11628	21601	21628	1601	1628
span02.04	12301	12328	22301	22328	2301	2328
span02.05	13001	13028	23001	23028	3001	3028
span02.06	13701	13728	23701	23728	3701	3728
span02.07	14401	14428	24401	24428	4401	4428
span02.08	15101	15128	25101	25128	5101	5128
span02.09	15801	15828	25801	25828	5801	5828
span02.10	16501	16528	26501	26528	6501	6528

Span 03	girder		slab		comp	
span03.01	10301	10328	20301	20328	301	328
span03.02	11001	11028	21001	21028	1001	1028
span03.03	11701	11728	21701	21728	1701	1728
span03.04	12401	12428	22401	22428	2401	2428
span03.05	13101	13128	23101	23128	3101	3128
span03.06	13801	13828	23801	23828	3801	3828
span03.07	14501	14528	24501	24528	4501	4528
span03.08	15201	15228	25201	25228	5201	5228
span03.09	15901	15928	25901	25928	5901	5928
span03.10	16601	16628	26601	26628	6601	6628

Span 04	girder		slab		comp	
span04.01	10401	10428	20401	20428	401	428
span04.02	11101	11128	21101	21128	1101	1128
span04.03	11801	11828	21801	21828	1801	1828
span04.04	12501	12528	22501	22528	2501	2528
span04.05	13201	13228	23201	23228	3201	3228
span04.06	13901	13928	23901	23928	3901	3928
span04.07	14601	14628	24601	24628	4601	4628
span04.08	15301	15328	25301	25328	5301	5328
span04.09	16001	16028	26001	26028	6001	6028
span04.10	16701	16728	26701	26728	6701	6728

Span 05	girder		slab		comp	
span05.01	10501	10528	20501	20528	501	528
span05.02	11201	11228	21201	21228	1201	1228
span05.03	11901	11928	21901	21928	1901	1928
span05.04	12601	12628	22601	22628	2601	2628
span05.05	13301	13328	23301	23328	3301	3328
span05.06	14001	14028	24001	24028	4001	4028
span05.07	14701	14728	24701	24728	4701	4728
span05.08	15401	15428	25401	25428	5401	5428
span05.09	16101	16128	26101	26128	6101	6128
span05.10	16801	16828	26801	26828	6801	6828

Span 06	girder		slab		comp	
span06.01	10601	10628	20601	20628	601	628
span06.02	11301	11328	21301	21328	1301	1328
span06.03	12001	12028	22001	22028	2001	2028
span06.04	12701	12728	22701	22728	2701	2728
span06.05	13401	13428	23401	23428	3401	3428
span06.06	14101	14128	24101	24128	4101	4128
span06.07	14801	14828	24801	24828	4801	4828
span06.08	15501	15528	25501	25528	5501	5528
span06.09	16201	16228	26201	26228	6201	6228
span06.10	16901	16928	26901	26928	6901	6928

Span 07	girder		slab		comp	
span07.01	10701	10727	20701	20727	701	727
span07.02	11401	11427	21401	21427	1401	1427
span07.03	12101	12127	22101	22127	2101	2127
span07.04	12801	12827	22801	22827	2801	2827
span07.05	13501	13527	23501	23527	3501	3527
span07.06	14201	14227	24201	24227	4201	4227
span07.07	14901	14927	24901	24927	4901	4927
span07.08	15601	15627	25601	25627	5601	5627
span07.09	16301	16327	26301	26327	6301	6327
span07.10	17001	17027	27001	27027	7001	7027

Каблови / Tendons 111 - 801

Наглавне греде / Pile caps

pile cap		
S2	80001	80006
S3	80042	80047
S4	80083	80088
S5	80124	80129
S6	80165	80170
S7	80206	80211

Лежишта/ Supports:

S1	bearing 1 - spring number: 50 bearing 2 - spring number: 51	S6	bearing 1 - spring number: 60 bearing 2 - spring number: 61

У улазним подацима су дефинисана сва оптерећења, која су задата на моделу. Иза тога су дефинисане комбинације оптерећења. Програмски пакет има посебну нумерацију за поједина оптерећења.

All loads assigned to the structural model were defined as part of the input stage, followed by load combinations. The software assigns unique load identification numbers to each individual load set, as shown below.

SW-SUM	**Сопствена тежина конструкције** / Self-weight of the structure
SL-PT	**Преднапрезање каблова** / Post tensioned tendons
SUM-PT	**Финално оптерећење од утезања** / Summation of pre-tensioning load
Onsite-SW-01	**Тежина свежег бетона од добетониране плоче** / Wet concrete load on precast girders (prior to composite action)
Final-SDL	**Додатно стално оптерећење** / Superimposed dead load
Final-CS	**Скупљање и течење конструкције** / Creep and shrinkage
CS-inf	**Након 10 000 дана** / Time period following 10 000 days
LM1-TS	**Покретно оптерећење – концентрисане силе** / Moving load – concentrated loads
LM1-UDL	**Покретно оптерећење – Расподељено оптерећење по тракама** / Moving load – uniformly distributed load
LM3	**Покретно оптерећење – покретно оптерећење за контролу замора** / Moving load – fatigue limit state
Brake	**Покретно оптерећење – силе покретања и кочења** / Moving load – acceleration and braking forces
WindS+T.sup	**Дејство ветра на мост са саобраћајним оптерећењем** / Wind load on traffic
WindS-T.sup	**Дејство ветра на мост без саобраћајног оптерећења** / Wind load, without traffic
Temp-U.sup	**Униформна температура** / Uniform temperature change
Temp-G.sup	**Темеператрни градијент** / Temperature gradient
EQ	**Сеизмичко оптерећење** / Seismic (earthquake) loads

Стално оптерећење је израчунато у односу на стварну тежину појединих елемента. Запреминска тежина армираног бетона износи γ=25,0 kN/m3. Програм на основу датих запреминских тежина материјала и димензија елемената конструкције израчунава властито оптерећење.

The self-weight of the structure was calculated based on the actual weight of individual elements. The unit weight of reinforced concrete was taken as $\gamma = 25{,}0\ kN/m^3$. Based on assigned material properties, unit weights and cross-sections, the self-weight is automatically computed by the software.

Оптерећења која се налазе на главном носачу: дебљина слојева на коловозној плочи (асфалтбетона, хидроизолације...) дато је као површинско оптерећење а сопствена тежине ограде, инсталација је дата као вертикално линијско оптерећење по дужини главних носача.

The following loads were applied to the girder: asphalt was modeled as an area load (inclusive of the depth of waterproofing), whereas the self-weight of the railing was applied as a vertical, uniformly distributed load along the length of the structure.

Корисна рачунска оптерећења су возила модела LM1 са комбинацијом концентрисаних сила и одговарајућим пратећим расподељеним оптерећењем. Оптерећују се две рачунске траке, са силама 300

kN, 200 kN, и силама од 100 kN у свим комбинацијама возила. Програм аутоматски узима у обзир најнеповољнији положај возила, обзиром на положај у попречном смислу који задаје корисник.

The primary moving load consists of Load Model 1 (LM1). This is a combination of a 300 kN double-axle load (referred to as the *Tandem System*) and a uniformly distributed load (referred to as the *UDL System*), applied in each traffic lane. Should there be more than one lane of traffic, the tandem system is reduced in adjacent lanes (i.e. 200 kN in lane 2, or 100 kN). Load model 3 (LM3) was considered as part of the fatigue analysis.

Реологија обухвата дуготрајне процесе скупљања и течења бетона те релаксацију каблова за преднапрезање. Коефицијент течења ϕ(t,t0) и релативне деформације скупљања εцс су узети у складу са прописима за релативну влажност околине 70%. Релаксација ужади за преднапрезање је узета програмски. Прорачун параметара реологије је у складу са редоследом и динамиком грађења и узети су у обзир програмски.

The rheology factor takes into account the creep and shrinkage of concrete, as well as relaxation of pretensioned strands. The creep coefficient $\phi(t,t_0)$ and relative shrinkage strain ε_{cs} were taken in accordance with a relative humidity of 70%. Strand relaxation properties were program-calculated. Rheology parameters were calculated in accordance with the sequence of construction, and were also applied by the program.

Температурни утицаји одређени су на основу улазних параметара: надморске висине, најмање и највеће температуре ваздуха.

Temperature loads were applied in accordance with the following input parameters: elevation above sea level, and total temperature difference between maximum and minimum.

Распонска конструкција при извођењу пролази кроз следеће фазе:

The bridge is constructed in the following sequence:

SubS: Изведени су стубови и темељи, тежина стубова случај оптерећења Subs-SW.. Активирано скупљање И течење бетона, оптерећење Subs-CS.

SubS: The foundations and piers are constructed, assigned a self-weight code of Subs-SW.

Precast: Изливање бетона монтажних носача који су на земљи и утезање каблова и временски утицаји релаксација челика, оптерећења SL-PT и Precast-CS.

Precast: prestressing of main girders laying on the ground and time-dependent losses including, but not limited to the relaxation of steel. Codes are assigned as SL-PT and Precast-CS.

Girder: Монтажа претходно напрегнутих носача – проста греда, и дејство временских утицаја на бетон, оптерећења: Girder-SW и Girder-CS.

Girder: Installation of precast girders– simply supported beam, and time-dependent losses of the poured concrete. Loads are assigned codes of Girder-SW and Girder-CS for the self-weight.

Stage.01: Ливење плоче, оптерећење: Onsite-SW-01

Stage.01: Pouring the cast-in-place slab. Loads prior to composite action are marked as Onsite-SW-01.

Final: Временски утицаји у плочи, наношење додатног сталног оптерећења. Ова фаза обухвата И прорачун додатног сталног оптерећења, као И реологију бетона за период 10 000дана. Оптерећења: Slab-CS-Stg01, Final-SDL и Final-CS.

Final: Time-dependent effects on the concrete slab and application of superimposed dead load. This phase also encompasses time-dependent effects on concrete for a period t = 10 000 days. Loads: Slab-CS-Stg01, Final-SDL and Final-CS.

Traffic: Прорачун покретног оптерећења LM1, LM3 (замор)

Traffic: Moving load LM1, LM3 (fatigue)

Temp: Прорачун температурног оптерећења

Temp: Temperature loads

Wind: Прорачун оптерећења од ветра

Wind: Wind loads

EarthQuake: Прорачун сеизмичког оптерећења

EarthQuake: Calculation of seismic (earthquake) loads

Рачунање комбинација / Combination stage: SLS-charac, SLS-freq, SLS-qu-permanent, Fatigue, ULS

Контрола допуштених вредности напона / Stresses check design:

FibSup: Гранично стање употребљивости, контрола напона у горњем и доњем влакну
FibSup: Serviceability limit state; calculation of stresses in the top and bottom fibres

CrackSup: контрола прслина – прорачун потребне арматуре за покривање прслина
CrackSup: crack width check – calculation of required reinforcement for preventing crack width opening

Fatigue: контрола замора
Fatigue: fatigue check

PrincSup: контрола главних напона затезања
PrincSup: principal stresses check

Провера носивости / Resistance check

ULScheck: Гранично стање носивости
ULScheck: Ultimate limit state

ShearCheck: Прорачун носивости на смицање
ShearCheck: Shear resistance calculations

2. КАРАКТЕРИСТИКЕ МАТЕРИЈАЛА

MATERIAL PROPERTIES

2.1 **УВОД** / INTRODUCTION

Ова анализа се односи на конструкције са типичним носачима од висине 900 мм
This analysis pertains to bridges having typical precast girders, with heights of 900 mm
Чврстоће бетона и класе изложености / Concrete strengths and exposure classes

- **Преднапрегнути носач** / Prestressed girder C45/55
- **Коловозна плоча** / Bridge deck C35/45
- **Средњи стубови** / Piers C30/37
- **Крајњи стубови и крилни зидови** / Abutments and wingwalls C30/37
- **Шипови** / Piles C30/37
- **Темељне стопе и наглавне греде** / Foundations and pile caps C30/37
- **Прелазне плоче** / Approach slabs C30/37

Прописи / Codes: **Европски стандард Eurocode EN 1990 – EN 1998** / European standards EN 1990 – EN 1998

2.2 **МАТЕРИЈАЛИ** / MATERIALS

Арматура / Reinforcement EN 10080

B500B – f_{yk}= 500 MPa
$f_{yd}= f_{yk} / \gamma_c$ = 500000 /1,15= 435 MPa
E= 200 000 MPa
Ограничење напона у арматури за карактеристичну комбинацију оптерећења (гранична стања употребљивости)

Reinforcement stress limits for the characteristic load combination (serviceability limit state)
0.8 x f_{yk}= 400 MPa

Бетон / Concrete EN 206 – **Класа чврстоће** / Concrete class C45/55

Карактеристична чврстоћа бетона при притиску (цилиндар) t = 28 dana

Characteristic concrete compressive strength (cylinder) at t = 28 days $f_{ck,cyl}$ = 45 MPa

Карактеристична чврстоћа бетона при притиску (коцка) т = 28 дана

Characteristic concrete compressive strength (cube) at t = 28 days $f_{ck,cube}$= 55 MPa

Средња вредност чврстоће при притиску т = 28 дана

Average compressive strength of concrete at t = 28 days $f_{cm,28}= f_{ck,cyl} + 8$ = 53 MPa

Прорачунска чврстоћа бетона при притиску

Design concrete strength $f_{cd} = \alpha_{cc} \times f_{ck,\,cyl} / \gamma_c$ = 0.85 x 45 / 1.5 = 25.5 MPa

Доња карактеристична чврстоћа бетона на затезање (5% фрактил)

Lower characteristic concrete tensile strength (5% fractile) $f_{ctk,0.05}$ = 2.66 MPa

Горња карактеристична чврстоћа при затезању (95% фрактил)

Upper characteristic concrete tensile strength (95% fractile) $f_{ctk,0.95}$ = 4.94 MPa

Средња чврстоћа на затезање

Average concrete tensile strength f_{ctm}= 3.80 MPa

Средња вредност модула еластичности бетона

Average modulus of elasticity of concrete E_{cm} = 36283 MPa

Ограничење напона притиска у бетону према ЕН 1992 за мостове (гранично стање употребљивости) / Concrete compressive stress limits in accordance with EN 1992 for bridges (serviceability limit state)

Ограничење напона притиска у бетону ради избегавања појаве подужних прслина и микропрслина:

Concrete compressive stress limits to avoid longitudinal cracks and micro-cracks

- **за карактеристичну (ретку) комбинацију оптерећења**
  characteristic load combination $0.6xf_{ck,cyl} = 0.60 \times 45MPa = 27MPa$
- **при наношењу силе преднапрезања (пре губитака) (SRPS EN 1992-1-1 NA 2.40)**
  at the time of prestressing (before losses) $0.7 \times (0.75 \times f_{c,cyl}) = 0.70 \times (0.75 \times 45) = 23.6$ MPa

Ограничење (сталног) напона притиска у бетону ради избегавања нелинеарне анализе течења бетона / Concrete (permanent) compressive stress limits to avoid nonlinear concrete creep analysis

- **за квази-сталну комбинацију оптерећења**
  quasi-permanent load combinations $0,45xf_{ck,cyl} = 0,45 \times 45 = 20.3$ MPa

Ограничење напона затезања у бетону према EN 1992/ Concrete tensile stress limits in accordance with EN 1992:

- **за карактеристичну (ретку) комбинацију оптерећења**
  characteristic load combination $f_{ctm} = 3.80$ MPa

Челик за преднапрезање / Prestressing steel EN 10138

- **Користи се уже са седам жица Y1860S7 /** 7-wire strands Y1860S7 are used in post-tensioning ducts

Пречник ужета / Strand diameter	15.7mm
Површина попречног пресека ужета / Strand cross-sectional area	$150mm^2$
Затезна чврстоћа / Tensile strength	1860 MPa
Маса по дужном метру / Mass per linear meter of 7-wire strand	1,180 kg/m
Карактеристична вредност максималне силе / Characteristic value of maximum force	259 kN
Максимална вредност максималне силе / Maximum value of maximum force	298 kN
Карактеристична вредност 0.1% доказне силе / Characteristic value of 0.1%-proof force	223 kN
Модул еластичности / Modulus of elasticity	195 GPa

- **Највећа сила затезања у ужету током преднапрезања (пре тренутних губитака и пре губитака који зависе од времена) /** Maximum tensile force in the strand during prestressing (prior to instantaneous and long-term losses)

  $P_{max}=Ap \times \min(k_1 \times f_{pk}; k_2 \times f_{p0.1k}) = 150mm^2 \times \min(0.80 \times 1860; 0.90 \times 1670) = \min(223kN; 225kN) = 223$ kN

- **Почетна сила преднапрезања у ужету (после тренутних губитака, а пре губитака који зависе од времена) /** Initial prestressing force in the strand (after instantaneous and before long-term losses):

  $P_{m0} \leq Ap \times \min(k_7 \times f_{pk}; k_8 \times f_{p0.1k}) = 150mm^2 \times \min(0.75 \times 1860; 0.85 \times 1670) = \min(209; 213) = 209$ kN

- **Ограничење напона у ужету за карактеристичну комбинацију оптерећења (гранична стања употребљивости) са силом преднапрезања након свих губитака**/ Prestressing steel stress limits for characteristic load combination (service limit state) with prestressing force after all losses

  $k_5 \times f_{pk} = 0.75 \times f_{yk} = 1252$ MPa

2.3 **ЗАШТИТНИ СЛОЈЕВИ БЕТОНА И КЛАСЕ ИЗЛОЖЕНОСТИ** / CONCRETE COVER AND EXPOSURE CLASSES

КАРАКТЕРИСТИКЕ МАТЕРИЈАЛА

Елемент	Бетон	Арматура	Заштитни слој
Претходно напрегнути носачи	C 45/55, XC4, , XF1, PV-II	B500B	4.0
Коловозна плоча и попр. носачи	C 35/45, XC3, , XF1, PV-II	B500B	4.0
Ивични венци и пешачке стазе	C 40/50, XC4, XD3, XF4, PV-II	B500B	4.5
Лежишне греде и квадери	C 30/37, XC3, , XF1, PV-I	B500B	4.0
АБ стубови	C 30/37, XC4, , XF1, PV-I	B500B	5.0
АБ потпорни зидови	C 30/37, XC4, , XF1, PV-I	B500B	5.0
Шипови	C 30/37, XC2, PV-I	B500B	мин 7.5cm
Наглавне греде	C 30/37, XC2, PV-I	B500B	5.0
Прелазна плоча	C 30/37, XC2, PV-I	B500B	5.0
Подбетон	C 12/15, X0		

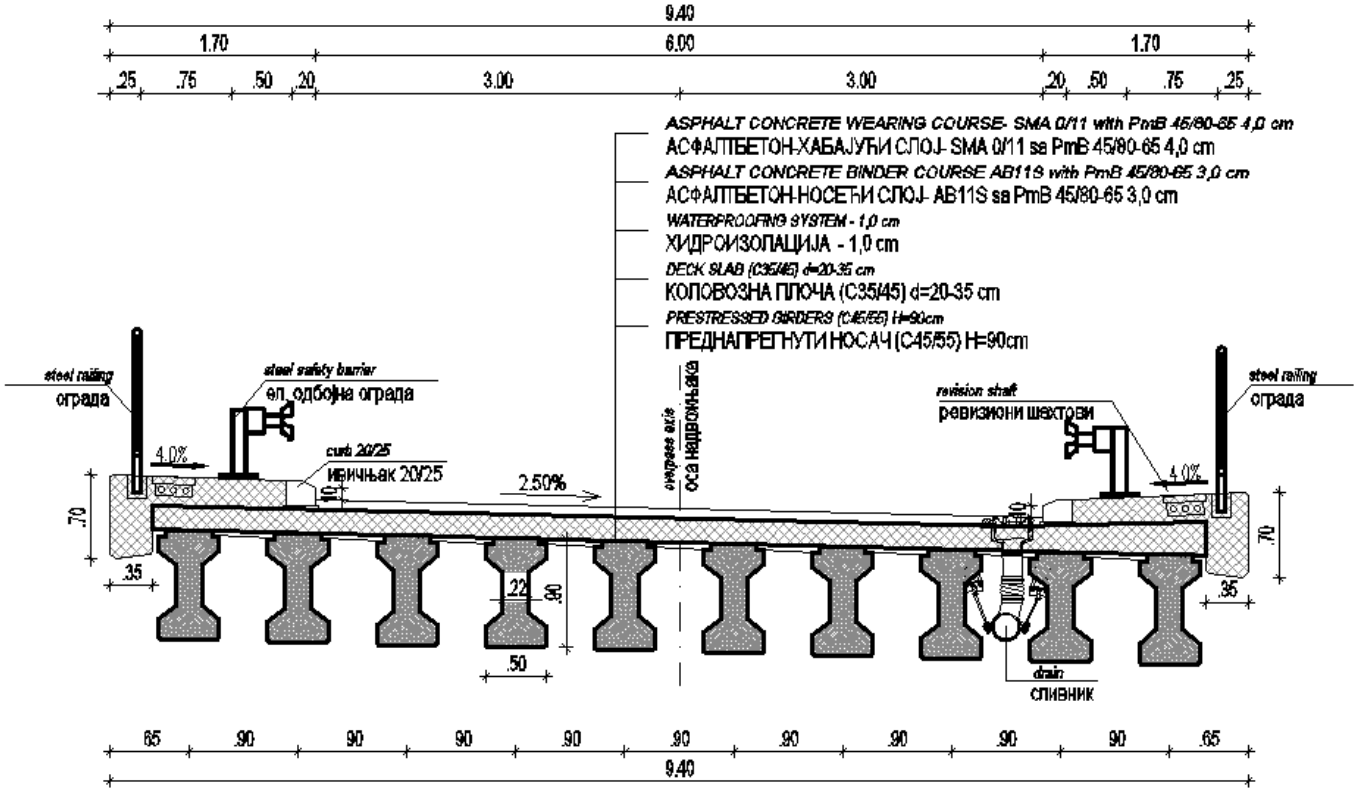
MATERIAL PROPERTIES

Component	Бетон	Reinforcement	Clear cover
Prestressed girders	C 45/55, XC4, , XF1, PV-II	B500B	4.0
Deck slab and diaphragms	C 35/45, XC3, , XF1, PV-II	B500B	4.0
Edge beams and sidewalks	C 40/50, XC4, XD3, XF4, PV-II	B500B	4.5
Pier caps and bearing pedestals	C 30/37, XC3, , XF1, PV-I	B500B	4.0
Pier columns and abutments	C 30/37, XC4, , XF1, PV-I	B500B	5.0
Retaining walls	C 30/37, XC4, , XF1, PV-I	B500B	5.0
Piles	C 30/37, XC2, PV-I	B500B	min 7.5cm
Pile caps	C 30/37, XC2, PV-I	B500B	5.0
Approach slabs	C 30/37, XC2, PV-I	B500B	5.0
Lean concrete	C 12/15, X0		

3. АНАЛИЗА ОПТЕРЕЋЕЊА

LOAD ANALYSIS

3. АНАЛИЗА ОПТЕРЕЋЕЊА ПРЕМА ЕС / LOAD ANALYSES IN ACCORDANCE WITH EC



3.1. СТАЛНА ОПТЕРЕЋЕЊА / DEAD LOADS

3.1.1. СОПСТВЕНА ТЕЖИНА / SELF-WEIGHT G1

Сопствена тежина преднапрегнутих греда и коловозне плоче аутоматски су узете у обзир у програмском пакету. / The self-weight of the post-tensioned, precast beams and deck are automatically taken into account by the design software.

3.1.2. **ДОДАТНИ СТАЛНИ ТЕРЕТ** / SUPERIMPOSED DEAD LOAD

Карактеристична вредност / Characteristic value

Асфалт / Asphalt		0.07 x 24.00 =	1.68 kN/m^2 x 6.00 = 10.08 kN/m
Хидроизолација / Waterproofing		0.01 x 24.00 =	0.24 kN/m^2 x 8.70 = 2.09 kN/m
Укупно / Total			*12.17 kN/m*
Пешачке стазе / Sidewalks:	A = 0.5307 m^2		
	e = -4.0596 m		q = 0.5307x25=13.267 kN/m
Ограда 1 / Barrier 1:	e = -4.4800 m		q = 0.5 kN/m
Ograda 2 / Barrier 2:	e = -3.5771 m		q = 0.5 kN/m

Укупно / Total ***26.44 kN/m***

Ексцентрицитет је у односу на центар коловозне плоче / Eccentricity is with respect to deck centerline

Увећана вредност / Maximum multiplier value

Асфалт / Asphalt		0.07 x 24.00 =	1.68 kN/m^2 x 6.00 x 1.40 = 14.11 kN/m
Хидроизолација / Waterproofing		0.01 x 24.00 =	0.24 kN/m^2 x 8.70 x 1.20 = 2.51 kN/m
Укупно / Total			*16.62 kN/m*
Пешачке стазе / Sidewalks:	A = 0.5307 m^2		
	e = -4.0596 m		q = 0.5307x25=13.267 kN/m
Ограда 1 / Barrier 1:	e = -4.4800 m		q = 0.5 kN/m
Ograda 2 / Barrier 2:	e = -3.5771 m		q = 0.5 kN/m

Укупно / Total ***30.89 kN/m***

Умањена вредност / Maximum multiplier value

Асфалт / Asphalt		0.07 x 24.00 =	1.68 kN/m^2 x 6.00 x 0.80 = 8.06 kN/m
Хидроизолација / Waterproofing		0.01 x 24.00 =	0.24 kN/m^2 x 8.70 x 0.80 = 1.67 kN/m
Укупно / Total			*9.73 kN/m*
Пешачке стазе / Sidewalks:	A = 0.5307 m^2		
	e = -4.0596 m		q = 0.5307x25=13.267 kN/m
Ограда 1 / Barrier 1:	e = -4.4800 m		q = 0.5 kN/m
Ograda 2 / Barrier 2:	e = -3.5771 m		q = 0.5 kN/m

Укупно / Total ***24.00 kN/m***

Zbog male razlike računaće se sa karalterističnom vrednošću / Due to the small difference, the characteristic value will be taken into account

3.1.3. **СКУПЉАЊЕ И ТЕЧЕЊЕ БЕТОНА** / CREEP AND SHRINKAGE OF CONCRETE

Влажност средине / Relative humidity: 70%

Прорачун модела од реолошких утицаја (EN 1992-2) је урађен у програмском пакету и приказан је у припадајућем случају оптерећења. / The calculation of creep and shrinkage (EN 1992-2) is automatically calculated by the structural engineering software package, and sorted into its respective load case.

3.1.4. **ПРЕДНАПРЕЗАЊЕ** / PRESTRESSING

Површина попречног пресека једног кабла / Cable cross-sectional area 6 x 150mm^2 = 900 mm^2

Количина кабла / Number of ducts

L = 16.55 m → n = 2

L 22.80 m → n = 3

3.2. **ПРОМЕНЉИВА ОПТЕРЕЋЕЊА** / LIVE LOADS

3.2.1. **САОБРАЋАЈНА ОПТЕРЕЋЕЊА** / TRAFFIC LOADS

3.2.1.1. **ПОДЕЛА КОЛОВОЗА НА ПРОРАЧУНСКЕ ВОЗНЕ ТРАКЕ** / NUMBER OF NOTIONAL LANES

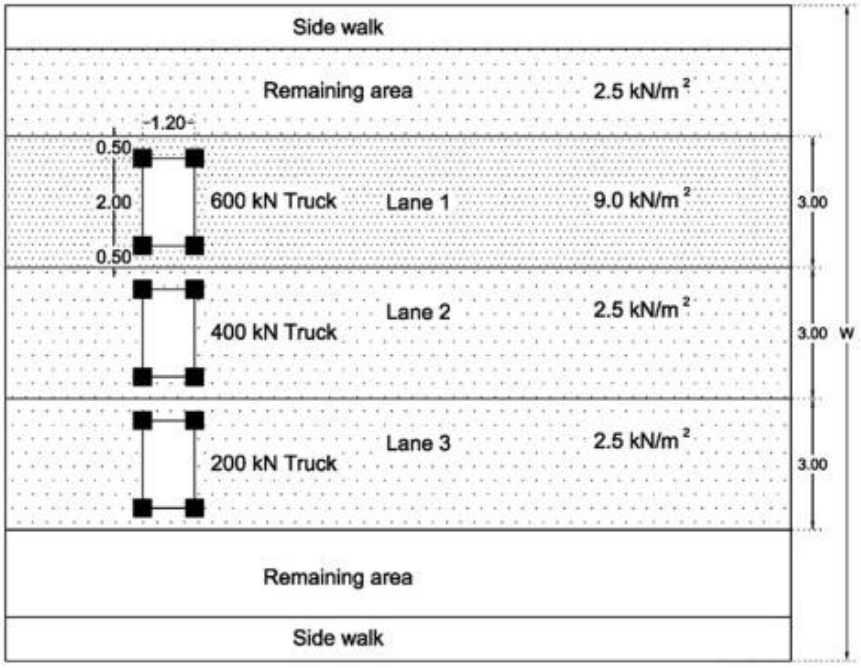
Ширина коловоза / Carriageway width: 6,00 m
Саобраћајне траке /Traffic lanes: w=Int(6.00/3) → 3,00+3,00 m
Број прорачунских возних трака / Number of notional lanes 2

3.2.1.2. **ГЛАВНИ МОДЕЛ ОПТЕРЕЋЕЊА (LM1)** / LOAD MODEL 1 (LM1)

Двоосовински тандем систем (TS) концентрисаних сила и једнакоподељено површинско оптерећење (UDL) / Tandem system (including two axles) (TS) and uniformly distributed load (UDL)

- **Прва трака** / First lane Q_{1k} = 0.8 x 2 x 300 kN = 480 kN q_{1k}= 0.8*9.00 kN/m^2 = 7.20 kN/m^2
- **Друга трака** / Second lane Q_{2k} = 0.8 x 2 x 200 kN = 320 kN q_{2k}= 1.0*2.50 kN/m^2 = 2.50 kN/m^2
- **Преостала површина** / Remaining area q_{rk}= 1.0 *2.50 kN/m^2=2.50 kN/m^2
- ➔ ***Није присутна у случају овог надвозњака*** */ Not present in the case of this bridge*

Сервисна стаза (ширина 0.75 м) / Sidewalk (0,75 m-wide) 3.00 kN/m^2

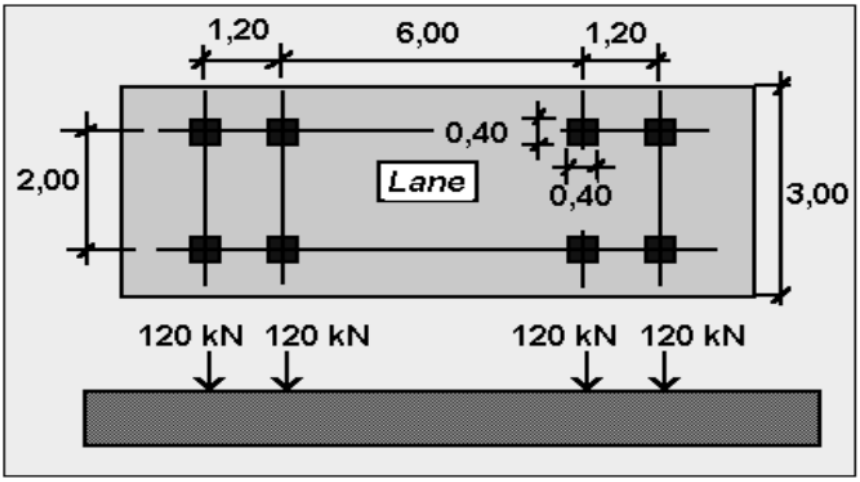


Šema modela opterećenja 1*/ Scheme of LM1*

Двоосовински тандем систем (TS) концентрисаних сила поставља се у свакој саобраћајној траци у комбинацији са једнакоподељеним површинским оптерећењем (UDL).

A double-axle load Tandem System (TS) is applied in each traffic lane in conjunction with a uniformly distributed load system (UDL).

МОДЕЛ ЗАМОР ОПТЕРЕЋЕЊА 3 (FLM3) / FATIGUE LOAD MODEL (FLM3)



Срачунава се опсег напона (алгебарска разлика између минималног и максималног напона) у елементу конструкције проузрокована проласком FLM 3. Тај опсег се онда користи да се срачуна еквивалентни опсег напона, пратећи Еврокод 2 Део 2 Анекс НН.2 / Stress range (algebraic difference between maximum and minimum stress) in the element of the structure caused by FLM3 crossing the bridge is calculated. Equivalent stress ranges are calculated following Eurocode 2 Part 2 Anex NN2.

Где је потребно, два FLM3 возила се постављају у исту траку, узимајући у обзир следеће услове:

1. **Друго возило је исте конфигурације као и прво, с тим да је тежина осовине другог возила 36 kN (а не 120 kN)**
2. **Раздаљина између два возила (мерена од центра једног возила до центра другог возила) није мања од 40м.**

Two vehicles in the same lane should also be considered, with the following conditions:

1. Second vehicle has the same geometry as the first vehicle, but with an axle load of 36 kN, and not 120kN.
2. Distance between vehicles (measured from the center of the first vehicle to the center of the second vehicle) is not less than 40m.

- **Модели оптерећења (на замор) 1 и 2 су предвиђени за неограничени животни век услед замора и генерално се не користе (јер су превисе на страни сигурности) /** Fatigue load models 1 and 2 have been developed for infinite fatigue life and are generally not used (they are overly conservative)
- **Модели оптерећења (на замор) 4 и 5 су предвидјени за детаљнију анализу и одредјивање спектра замора (засновану на Палмгерн-Минер Закону) и нису коришћени у овом случају (није предвидјена њихова употреба по Еврокоду за овај тип конструкције) /** Fatigue load models 4 and 5 have been developed for refined analysis (based on Palmgern-Miner's Law) and are not used in this case (their use is not intended by Eurocode for these types of structure)

3.2.1.3. **СИЛЕ ПОКРЕТАЊА И КОЧЕЊА ВОЗИЛА / ACCELERATION AND BRAKING FORCE OF VEHICLES**

$180kN \cdot \alpha_{Q1} \leq Q_{lk} = 0.60 \cdot \alpha_{Q1} \cdot (2 \cdot Q_{1k}) + 0.10\ \alpha_{q1} \cdot q_{1k} \cdot wl \cdot L \leq 900\ kN$

α_{Q1}= 0.8	Q_{1k}= 300 kN
α_{q1}= 0.8	q_{1k}= 9,00 kN/m2
w_l=3.00m	L=16.65 + 5 x 23.2 + 16.65 = 149.30 m

Q_{lk}= 0.60·0.8·(2·300)+0.1·0.8·9.00·3.00·149.30= 610 kN

Усвојена вредност силе прихваћене од стране 4 стуба / Force to be resisted by four piers:

±610 kN (610/149.3 = 4.09 kN/m')

3.2.1.4. **ОПТЕРЕЋЕЊЕ НА ПЕШАЧКИМ СТАЗАМА** / PEDESTRIAN LOAD ON FOOTWAY

Карактеристично оптерећење на пешачким стазама

Characteristic pedestrian load on sidewalks

q_{fk} = 5 kPa

За прорачуне локалних елемената, потребно је анализирати и карактеристичну вредност концентрисане силе Q_{fwk} која делује на површини 10цм x 10цм на пешачкој стази

For local effects, characteristic value of concentrated load Q_{fwk}, acting on a 10 cm^2 surface on footway should also be considered.

Q_{fwk} = 10 kN

3.2.2. **УТИЦАЈИ ОД ТЕМПЕРАТУРЕ** / TEMPERATURE LOADS

ТЕМПЕРАТУРНИ УТИЦАЈИ НА ГЛАВНОМ НОСАЧУ / TEMPERATURE, SUPERSTRUCTURE
Дебљина коловоза / Surfacing (asphalt and waterproofing) thickness: 80mm

Равномерна температурна промена / Uniform temperature change

Почетна температура при којој је конструкција моста комплетирана, односно постављена на лежишта / Temperature at the end of construction (when superstructure is set on bearings)
$T_0 = 10^0$ C
Најмања и највећа температура ваздуха (Нови Сад–Суботица) /Maximum and minimum air temperature (Novi Sad–Subotica)
$T_{max} = 42^0$C
$T_{min} = -29^0$C
Најмања и највећа температура надконструкције / Maximum and minimum superstructure temperature:
$T_{e,max} = T_{max} + 2 = 44^0$C
$T_{e,min} = T_{min} + 8 = -21^0$C
Максимална негативна рачунска температура / Maximum contraction range of the uniform temperature change
$\Delta T_{N,con} = T_0 - T_{e,min} = 10+21 = -31^0$C
Максимална позитивна рачунска температура / Maximum expansion range of the uniform temperature change
$\Delta T_{N,exp} = T_{e,max} - T_0 = 44-10 = +34^0$C
Прорачун лежишта и дилатација / Design of expansion joints and bearings:
$\Delta T_{N,neg} = \Delta T_{N,com} - 20 = -31-20 = -51^0$C
$\Delta T_{N,pos} = \Delta T_{N,max} + 20 = 34+20 = +54^0$C

Линеарна промена температуре / temperature gradient **:**

Карактеристична вредност линеарне промене температуре (Еврокод Приступ 1) / Characteristic temperature gradient (Eurocode Approach 1):
$\Delta T_{M,heat} = 15^o$
$\Delta T_{M,cool} = 8^o$
Фактор утицаја дебљине коловоза / Surfacing thickness factor
$k_{sur} = 0.82$ – **Горња страна топлија** / Top surface warmer
$k_{sur} = 1.0$ – **Доња страна топлија** / Bottom surface warmer

Линеарно променљива температура / Temperature gradient
Горња страна / Top surface $\Delta T_{M,heat} = 15^o \times 0.82 = 12.3^0$C
Доња страна / Bottom surface $\Delta T_{M,cool} = 8^o \times 1.0 = 8^0$C

Комбинација равномерне температурне промене и линеарне промене температуре / Combinations of uniform temperature change and temperature gradient
$\omega_N = 0.35$ $\omega_M = 0.75$
$\Delta T_{N,exp} = +44^0$ $\Delta T_{M,heat} = 12.3^0$

$\Delta T_{N,con} = -21^0$ $\Delta T_{M,cool} = 8^0$
Усваја се неповољнија комбинација / The following combinations are considered:

$\Delta T_{M,heat}$ (ili/or $\Delta T_{M,cool}$) + ω_N* $\Delta T_{N,exp}$ (ili/or $\Delta T_{N,con}$)
ω_M *$\Delta T_{M,heat}$ (ili/or $\Delta T_{M,cool}$) + $\Delta T_{N,exp}$ (ili/or $\Delta T_{N,con}$)

ТЕМПЕРАТУРНИ УТИЦАЈИ НА СТУБОВИМА / TEMPERATURE LOADS IN PIERS

Линеарна промена температуре / Temperature gradient: $\Delta_t = 5^0$

3.2.3. **ОПТЕРЕЋЕЊЕ ВЕТРОМ /** WIND LOADS (w)

Утицај ветра на суперструктуру / Wind loads on superstructure

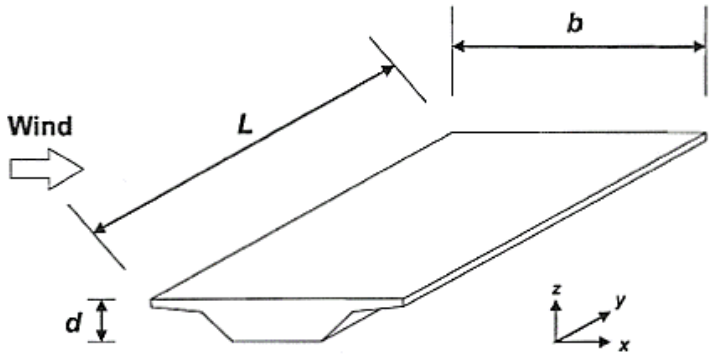


Figure 8.2 — Directions of wind actions on bridges

Висина објекта изнад терена / Bridge height above ground h = 9.70 m

Ширина објекта / Bridge width b = 9.40 m

Висина надконструкције / Superstructure height d = 1.10 m

Дужина моста припадајућа једном стубу / Tributary length for one pier 23.20 m

Локација/Location: Novi Sad – Subotica

Фундамнетална основна брзина ветра /

Fundamental basic wind velocity v_{b0}= 20 m/s (Novi Sad 21m/s, Subotica 19 m/s)

Фактор оптерецења ветром (EC 1991-1-4, Wind load factor C (EC 8.3.2, Table 8.2)

$C = c_e \times c_f = 2.329 \times 1.3 = 3{,}0277$

- **Оптерећење у x правцу**

Fundamentnalna osnovna brzina vetra / Fundamental basic wind velocity — $v_{bo} := 20 \cdot \frac{m}{s}$ Vojvodina

Koeficijent pravca delovanja vetra / Directional factor — $C_{dir} := 1.0$

Koeficijent sezonskog delovanja / Seasonal factor — $C_{seas} := 1.0$

Osnovna brzina vetra / Basic wind velocity — $v_b := C_{dir} \cdot C_{seas} \cdot v_{bo} = 20 \frac{m}{s}$

Gustina vazduha / Air density — $\rho := 1.25 \frac{kg}{m^3}$

Druga kategorija terena je usvojena. / Second terrain category is assumed.

Parametri hrapavosti terena / Roughness parameters — $z_o := 0.05m$ $z_{min} := 2m$ $k_r := 0.19$

Referentna visina / Reference height — $z := 9.7m$

Koeficijent hrapavosti terena / Roughness coefficient — $c_r := k_r \cdot \ln\left(\frac{z}{z_o}\right) = 1$

Koeficijent topografije terena / Orography coefficient — $c_o := 1$

Srednja (proseč na) brzina vetra / Mean wind velocity — $v_m := c_r \cdot c_o \cdot v_b = 20 \frac{m}{s}$

Koeficijent turbulencije / Turbulence factor — $k_l := 1$

Intenzitet turbulencije / Turbulence intensity — $I_v := \frac{k_l}{c_o \cdot \ln\left(\frac{z}{z_o}\right)} = 0.19$

Koeficijent izlož enosti / Exposure factor — $c_e := 1 + 7 \cdot I_v = 2.329$

Koeficijent sile / Force coefficient — $c_f := 1.3$

Koeficijent konstrukcije kojim se uzima u obzir njen dinamicki odgovor / Dynamic response coefficient — $c_s := 1$ $c_d := 1$

Dubina superstrukture za referentnu povrsinu (most opterecen saobracajem) / Superstructure depth for reference area (bridge loaded with traffic) — $d_{tot\_tr} := 1.1m + 2m = 3.1\,m$

Dubina superstrukture za referentnu povrsinu (most neopterecen saobracajem) / Superstructure depth for reference area (bridge not loaded with traffic) — $d_{tot} := 1.1m + 3 \cdot 0.3m = 2\,m$

Linijsko opterećenje vetrom (most opterećen sa saobracajem) / Line wind load (wind loaded with traffic) — $f_{w\_z} := c_s \cdot c_d \cdot c_e \cdot \frac{1}{2} \cdot \rho \cdot v_m^2 \cdot c_f \cdot d_{tot\_tr} = 2.35 \cdot \frac{kN}{m}$

Linijsko opterećenje vetrom (most neopterećen sa saobracajem) / Line wind load (wind loaded with traffic) — $f_{w\_} := c_s \cdot c_d \cdot c_e \cdot \frac{1}{2} \cdot \rho \cdot v_m^2 \cdot c_f \cdot d_{tot} = 1.52 \cdot \frac{kN}{m}$

- **Оптерећење ветром у y је занемарено.**
- **Оптерећење у Z правцу**

Као сто је поменуто у Еврокоду Део 1.4 8.3.3 Примедба 2, сила ветра у z правцу мозе да има значајан ефекат само ако је истог реда величине као и стално оптерећење. С обзиром да је ова сила доста мања од сталног оптерећења, неце се даље разматрати у анализи. / As noted in Eurocode Part 1.4 8.3.3 Note 2, the wind force in the Z direction may have significant effects provided that the force is of the same order of magnitude as the dead load. In the case of these particular bridges, this force is significantly smaller than the dead load, and as such is discarded from further analysis.

3.2.4. **ЗАМЕНА ЛЕЖИШТА /** REPLACEMENT OF BEARINGS

Δ_s =+1,00 cm **на svakom stubu sa ležištima** / at every support with bearings

3.2.5. **СЛЕГАЊЕ ОСЛОНАЦА /** SETTLEMENT

Δ_s =-1,00 cm

3.3. ИНЦИДЕНТНА ОПТЕРЕЋЕЊА / INCIDENTAL LOADS

3.3.1. СЕИЗМИЧКИ УТИЦАЈИ / EARTHQUAKE LOADS

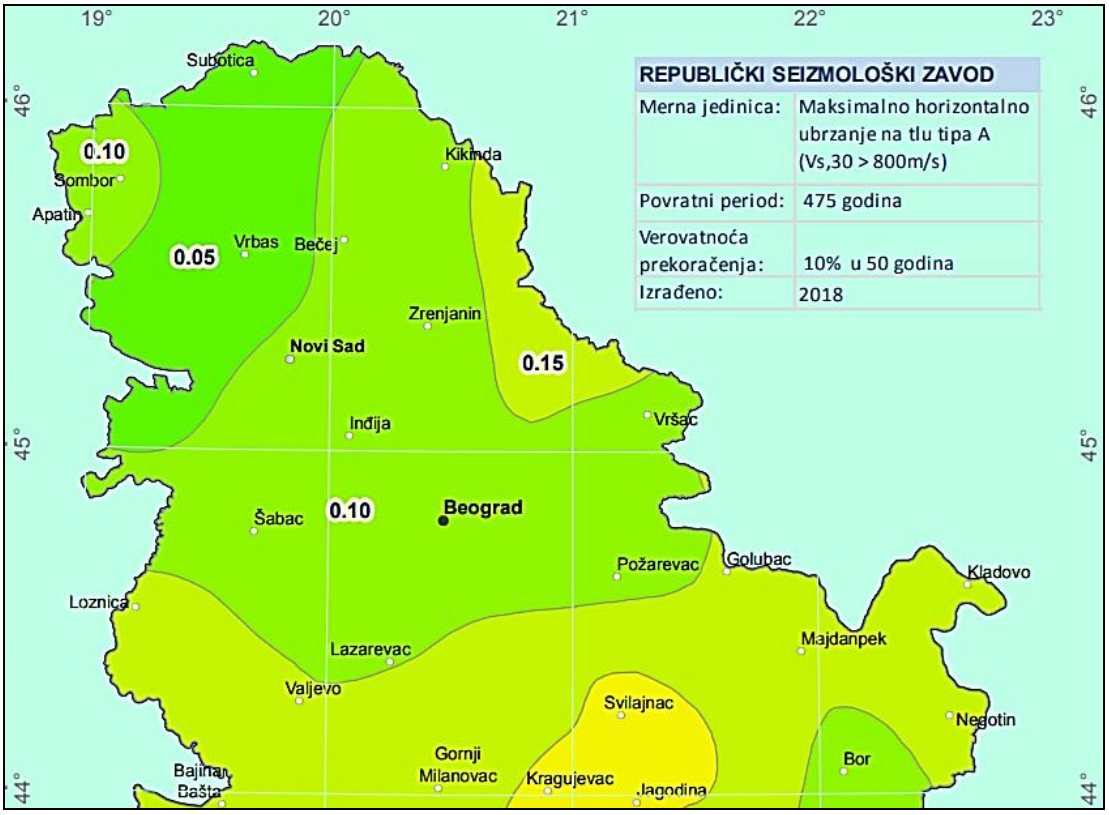
Метода анализе: Метода фундаменталног тона (EN 1998 Део 2). /
Method of analysis: Fundamental Mode Method (EN 1998 Part 2).

Локација / Location: Novi Sad – Subotica, Serbia

Фактор значаја моста /Importance factor: γ_i=1,0

Рачунско убрзање тла (очитано са мапе за тип тла А, касније се модификује за усвојени тип тла) / Design ground acceleration (read from the map for ground type A, and subsequently modified for the given soil type):

$a_g = \gamma_i \times a_{gr}$=0.05g (**повратни период 475** / return period of 475 years)



Tip tla / Soil type:

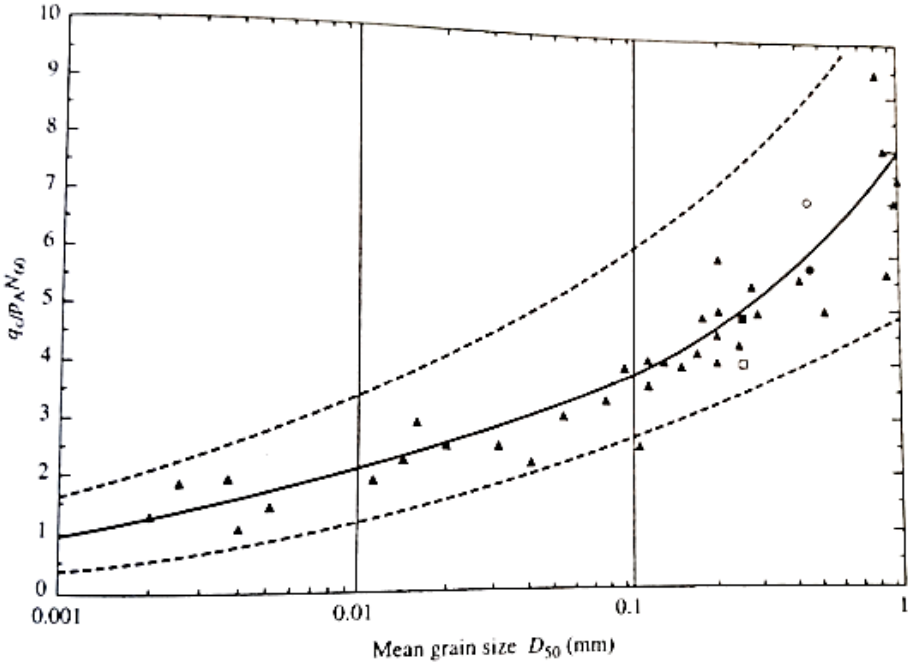


Figure 7-38
Correlation between CPT cone resistance and SPT blow count. *(Robertson et al. 1983; with permission from ASCE)*

Усвојен тип тла С према EN 1998-1 / Soil type C is used (EN 1998-1)

Проценат вискозног пригушења / Viscous damping ratio: ξ=5%

Фактор пригушења / Damping factor: η=1,00

Фактор понашања / Behaviour factor:

q=1,00

Рачунске сеизмичке силе према EC8/1 / Earthquake design loads according to EC8 /1

$E_x + 0{,}3E_y + 0{,}3E_z$
$0{,}3E_x + E_y + 0{,}3E_z$
$0{,}3E_x + 0{,}3E_y + E_z$

Једначине пројектног спектра одговора за еластичну анализу
Equations for design spectrum, following an elastic analysis
Пројектни спектар за хоризонталне компоненте
Design spectrum for horizontal components

$0 \le T \le T_B: \; S_d(T) = a_g \cdot S \cdot \left[\frac{2}{3} + \frac{T}{T_B}\left(\frac{2.5}{q} - \frac{2}{3}\right)\right]$

$T_B \le T \le T_C: \; S_d(T) = a_g \cdot S \cdot \frac{2.5}{q}$

$T_C \le T \le T_D: \; S_d(T) \begin{cases} = a_g \cdot S \cdot \frac{2.5}{q} \cdot \left[\frac{T_c}{T}\right] \\ \ge \beta \cdot a_g \end{cases}$

$T_D \le T: \; S_d(T) \begin{cases} = a_g \cdot S \cdot \frac{2.5}{q} \cdot \left[\frac{T_c \cdot T_d}{T^2}\right] \\ \ge \beta \cdot a_g \end{cases}$

β=0,2

- **Вредности параметара који дефинишу Еластични спектар одговора**

  Parameters describing the elastic response spectrum

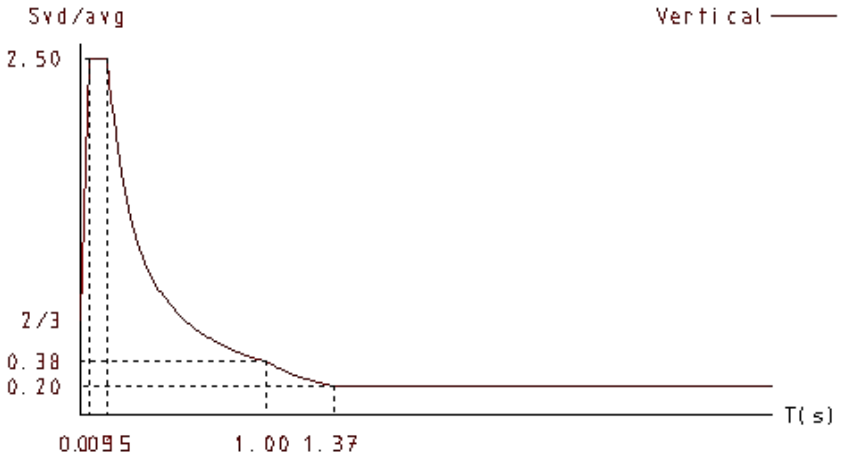
Tip tla	S	T_B(s)	T_C(s)	T_D(s)
A	1	0.15	0.4	2
B	1.2	0.15	0.5	2
C	1.15	0.2	0.6	2
D	1.35	0.2	0.8	2
E	1.4	0.15	0.5	2

- **Вредности параметара који дефинишу Вертикални еластични спектар одговора**

  Parametars describing the vertical elastic response spectrum

Spektar	a_{vg}/a_g	T_B(s)	T_C(s)	T_D(s)
Tip 1	0.9	0.05	0.15	1.0

За пројектни спектар / For design spectrum q=1,0



3.4. КОМБИНАЦИЈЕ ОПТЕРЕЋЕЊА ПРЕМА EC / LOAD COMBINATIONS IN ACCORDANCE WITH EC

Комбинације за гранично стање употребљивости / Combinations at the serviceability limit state, SLS

Карактеристичне комбинације оптерећења / Characteristic load combinations

$$\sum_{j\geq 1}\left(G_{kj,sup}+G_{kj,inf}\right)+P_K+\begin{cases}(TS+UDL+q_{fk}^{*})+0.6*F_{wk,traffic}\\ gri_{i=1b,2,3,6}+0.6*T_k\\ gr1b\\ T_K+(0.75*TS+0.4*UDL+0.4*q_{fk}^{*})\\ F_{Wk}\end{cases}$$

Честе комбинације оптерећења / Frequent load combinations

$$\sum_{j\geq 1}\left(G_{kj,sup}+G_{kj,inf}\right)+P_K+\begin{cases}(0.75*TS+0.4*UDL)+0.5*T_K\\ 0.75*gr1b\\ 0.6*T_K\\ 0.2*F_{Wk}\end{cases}$$

Квази-перманентне комбинације оптерећења / Quasi-permanent load combinations

$$\sum_{j\geq 1}\left(G_{kj,sup}+G_{kj,inf}\right)+P_K+0.5*T_K$$

Комбинације за гранично стање носивости / Combinations at the ultimate limit state, ULS

Сталне прорачунске ситуације / Persistent design situations

$$\sum_{j\geq 1}\left(1.35*G_{kj,sup}+1.00*G_{kj,inf}\right)+\gamma_P*P_K+\begin{cases}1.35*(TS+UDL+q_{fk}^{*})+1.5*0.6*F_{wk,traffic}\\ 1.35*gri_{i=1b,2,3,6}\\ 1.5*T_K+1.35*(0.75*TS+0.4*UDL+0.4*q_{fk}^{*})\\ 1.5*F_{Wk}\end{cases}$$

- $G_{kj,sup}$ – **карактеристичне вредности сталних дејстава (неповољно дејство)** / characteristic dead load (unfavourable action)
- $G_{kj,inf}$ – **карактеристичне вредности сталних дејстава (повољно дејство)** / characteristic dead load (favourable action)
- γ_P – 1.0; P_k – **репрезентативна (средња) вредност дејства услед преднапрезања** / representative (mean) prestressing force
- TS – **Двоосовински тандем систем концентрисаних саобраћајних сила** / Tandem system traffic load
- UDL – **Једнакоподељено површинско саобраћајно оптерећење** / Uniformly distributed traffic load
- q_{fk}* – **оптерећење за комбиновање пешачких стаза** / combination value of vertical loads on sidewalks
- $F_{wk,traffic}$ – **оптерећење ветром када је присутно и саобраћајно оптерећење на мосту /** wind loads taking into consideration the presence of road traffic
- gri_i – **групе саобраћајних оптерећења /** traffic load groups
- T_k – **карактеристична вредност температурног оптерећења /** characteristic value of wind load
- F_{wk} – **карактеристична вредност оптерећења ветром /** characteristic value of wind load

		Коловоз						Пешачке и бицикл. стазе
Тип оптерећења		Вертикалне силе				Хоризонталне силе		Само вертикалне силе
Референца из SRPS EN 1991-2:2012		4.3.2	4.3.3	4.3.4	4.3.5	4.4.1	4.4.2	5.3.2 (1)
Систем оптерећења		LM1 (TS и UDL)	LM2 (једна осовина)	LM3 (специјална возила)	LM4 (пешачка навала)	Q_{lk} Силе кочења и покретања	Q_{tk} Центрифу–галне и по–пречне силе	
Групе оптерећења	gr1a	Карактеристи–чна вредност						3,00 kN/m^2
	gr1b		Каракт. вредност					
	gr2	Честа вредност				Каракт. вредност	Каракт. вредност	
	gr3[d]							Каракт. вредност[c]
	gr4				Каракт. вредност			Каракт. вредност
	gr5			Каракт. вредност				
	gr6[e]	0,5 × Каракт. вредност				0,5 × Каракт. вредност	0,5 × Каракт. вредност	Каракт. вредност
		Доминантно компоненто дејство.						

[c] Видети SRPS EN 1991-2:2012, тачка. 5.3.2.1(2). Разматра се само једна оптерећена пешачка стаза ако је то неповољније од обе оптерећене пешачке стазе.
[d] gr3 није релевантан, ако се разматра gr4.
[e] gr6 се примењује само за прорачунске ситуације које се односе на замене лежишта.

Grupe saobraćajnih opterećenja / *Traffic load groups*

Оптерећења LM3 и ЛМ4 нису захтевана од стране инвеститора (њихова употреба није уобицајена), па се групе оптерећење гр4 и гр5 не користе / Load models LM3 and LM4 have not been requested (these loads are not commonly used in practice); thus, load groups gr4 and gr5 have not been considered

Прорачунске ситуације за замор/ Fatigue design situations

Срачунати прорачунски опсег напона се упоредјује са номиналном носившћу на замор (за челик за армирање, за каблове за преднапрезање, и за бетон у притиску и при смицању) одредјену према Еврокод 2 Део 1.1 Члан 6.8.5. / Calculated design stress range is then compared with nominal fatigue resistance calculated according to Eurocode 2 Part 1.1 Article 6.8.5 (for reinforcement steel, prestressing steel, concrete compression and concrete shear)

Израз за проверу замора у челику за армирање и кабловима за преднапрезање / Expression for fatigue check for reinforcement and prestressed steel

$\gamma_{F,fat} * \Delta\sigma_{s,equ}(N^*) \leq (\Delta\sigma_{Rsk}(N^*)) / \gamma_{S,fat}$

Парцијални фактор за замор оптерећење (Evrokod 2 Part 1.1 - 2.4.2.3) / Partial factor for fatigue loads (Eurocode 2 Part 1.1 - 2.4.2.3)

$\gamma_{F,fat} = 1.0$

Парцијални фактор за материјале (Evrokod 2 Part 1.1 - 2.4.2.4) / Partial factor for materials (Eurocode 2 Part 1.1 - 2.4.2.4)

Бетон / Concrete $\gamma_{C,fat} = 1.5$

Челик за армирање и за преднапрезање / Reinforcement and prestressing steel $\gamma_{S,fat} = 1.15$

Инцидентне и сеизмицке прорацунске ситуације / Accidental and seismic design situations

Table A2.5 - Design values of actions for use in accidental and seismic combinations of actions

Design situation	Permanent actions		Prestress	Accidental or seismic action	Accompanying variable actions (**)	
	Unfavourable	Favourable			Main (if any)	Others
Accidental(*) (Eq. 6.11a/b)	$G_{k,j,sup}$	$G_{k,j,inf}$	P	A_d	$\psi_{1,1} Q_{k,1}$ or $\psi_{2,1} Q_{k,1}$	$\psi_{2,i}\ Q_{k,i}$
Seismic(***) (Eq. 6.12a/b)	$G_{k,j,sup}$	$G_{k,j,inf}$	P	$A_{Ed} = \gamma_I A_{Ek}$		$\psi_{2,i}\ Q_{k,i}$

(*) In the case of accidental design situations, the main variable action may be taken with its frequent or, as in seismic combinations of actions, its quasi-permanent values. The choice will be in the National Annex, depending on the accidental action under consideration.

(**) Variable actions are those considered in Tables A2.1 to A2.3.

(***) The National Annex or the individual project may specify particular seismic design situations. For railway bridges only one track need be loaded and load model SW/2 may be neglected.

NOTE The design values in this Table A2.5 may be changed in the National Annex. The recommended values are $\gamma = 1{,}0$ for all non seismic actions.

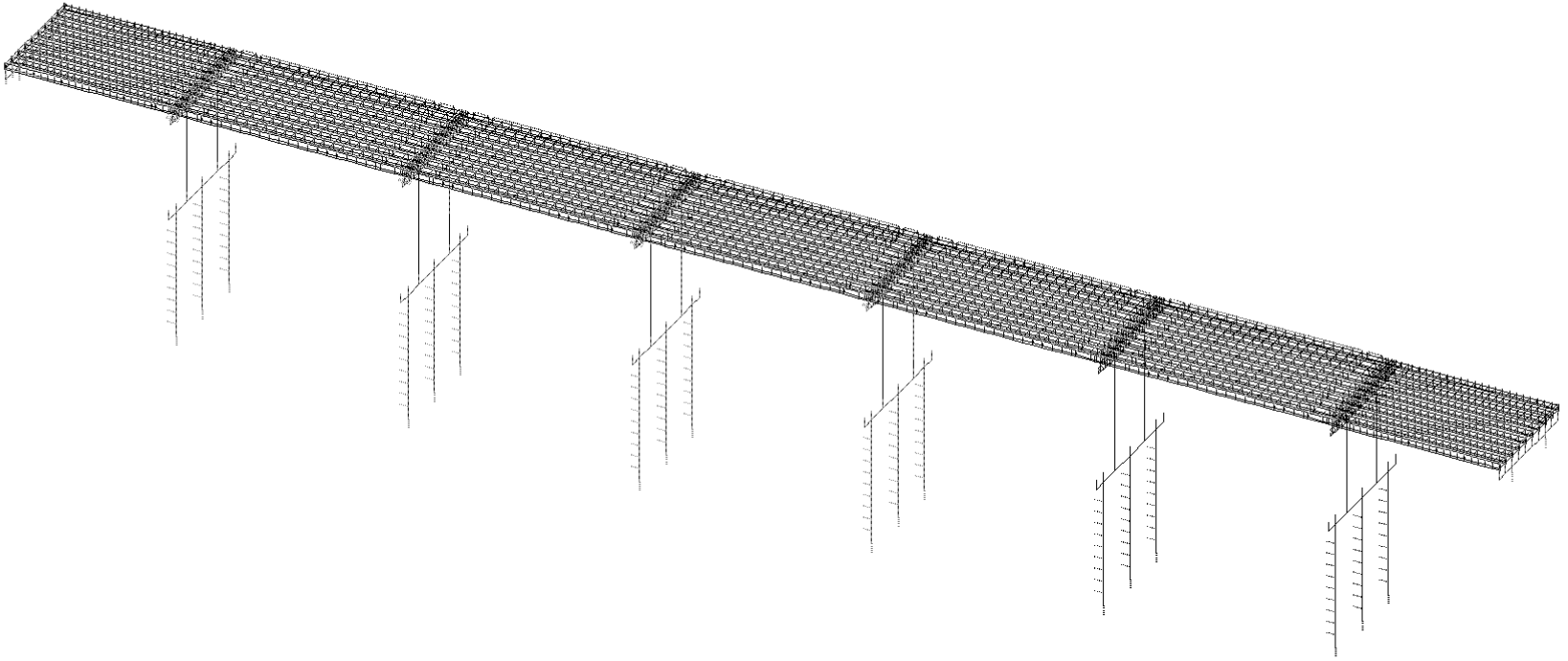
4. ИЗВЕШТАЈ СТРУКТУРАЛНЕ АНАЛИЗЕ

STRUCTURAL ANALYSIS REPORT

4.1. СТРУКТУРАЛНИ МОДЕЛ МОСТА, КАРАКТЕРИСТИКЕ МАТЕРИЈАЛА, ГЕОМЕТРИЈСКЕ КАРАКТЕРИСТИКЕ ПОПРЕЧНИХ ПРЕСЕКА

ANALYTICAL MODEL, MATERIAL PROPERTIES, SECTION PROPERTIES

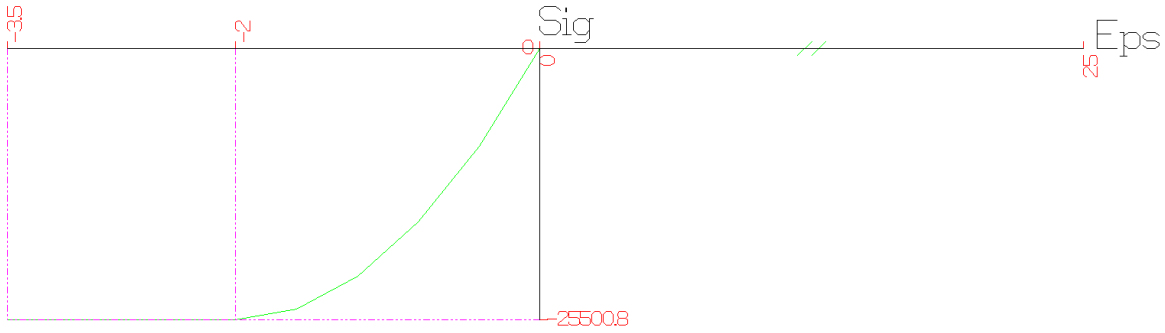
Structural Model
Stage



Isometric view

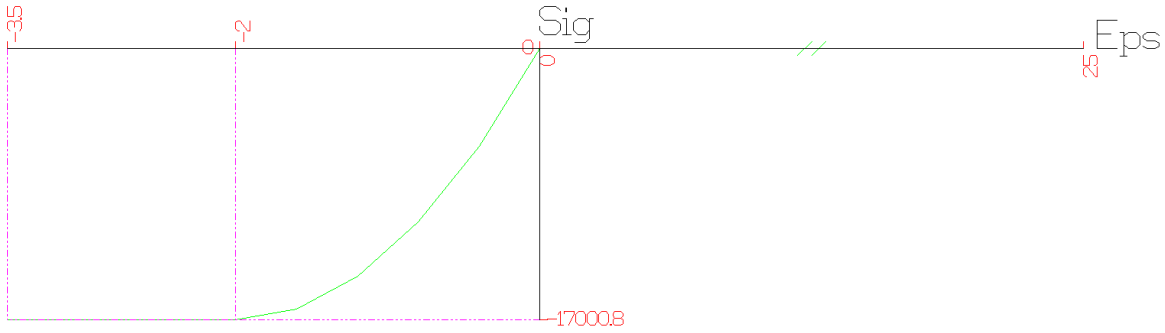
Plot 'pl-geom-stg.pl' from 18 APR 2021

Material Ultimate diagram
ENEurocode:C45/55



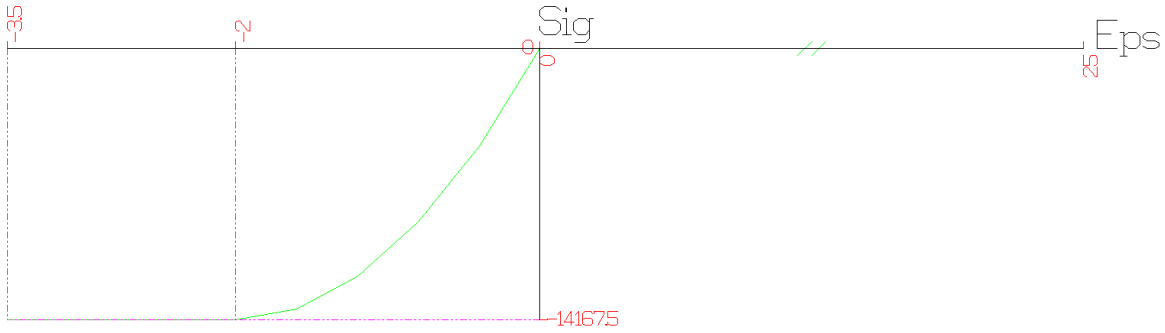
EPS	SIG (kN/m2)	Delt-L	Delt-R	Delt-inp

Material Ultimate diagram
ENEurocode:C30/37



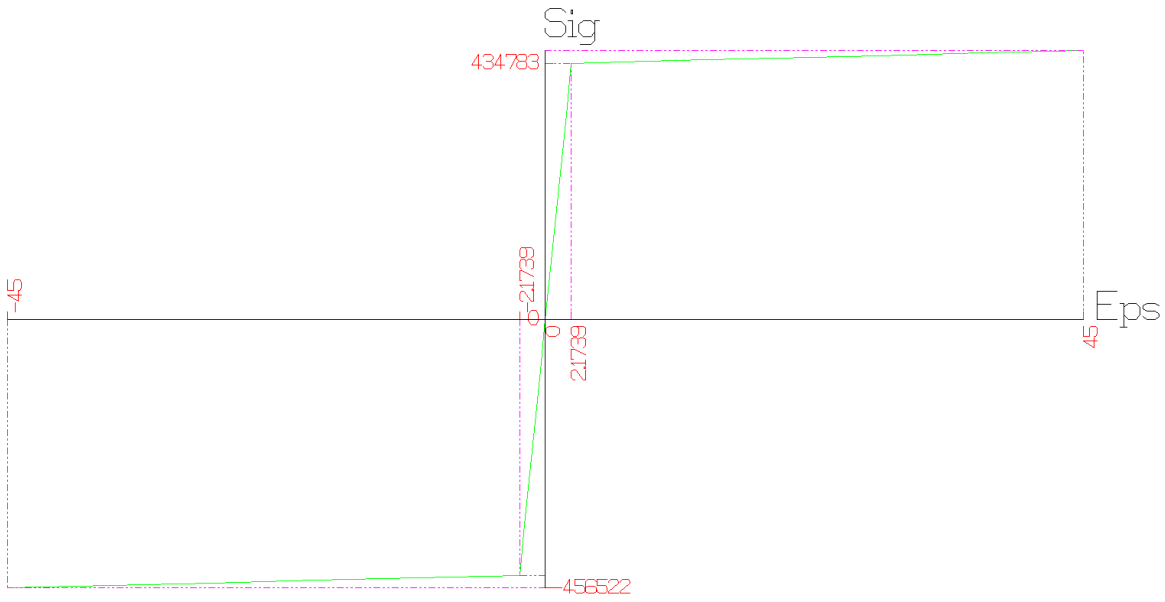
EPS	SIG (kN/m2)	Delt-L	Delt-R	Delt-inp

Material Ultimate diagram
EN Eurocode:C25/30



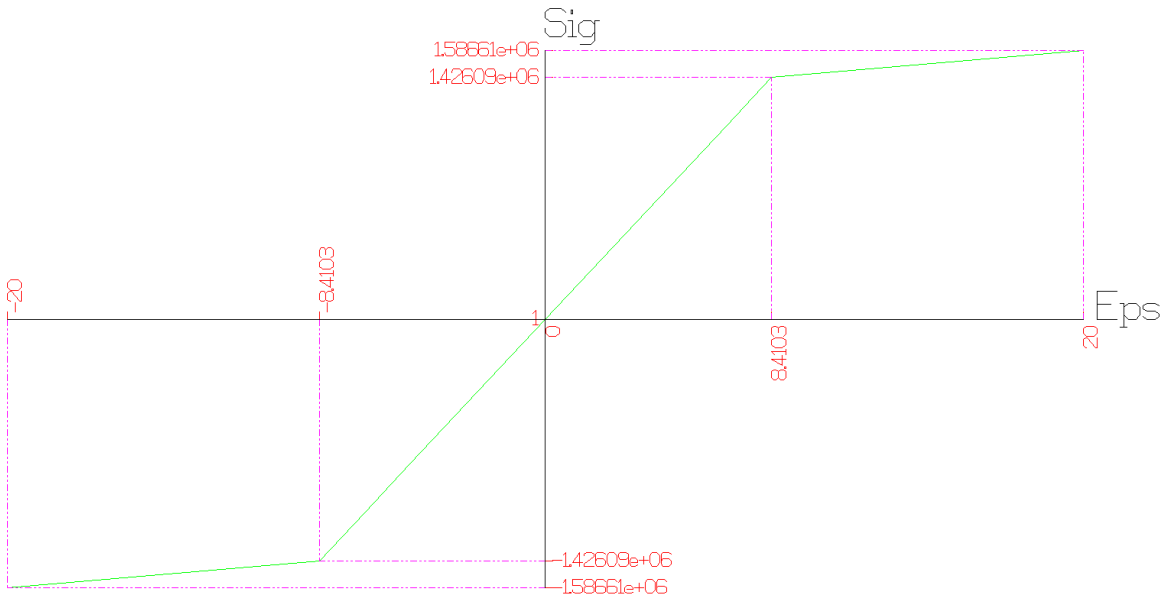
EPS	SIG (kN/m2)	Delt-L	Delt-R	Delt-inp

Material Ultimate diagram
EN Eurocode:St500(B)



EPS	SIG (kN/m2)	Delt-L	Delt-R	Delt-inp

Material Ultimate diagram
EN Eurocode:Strand-1640/1860



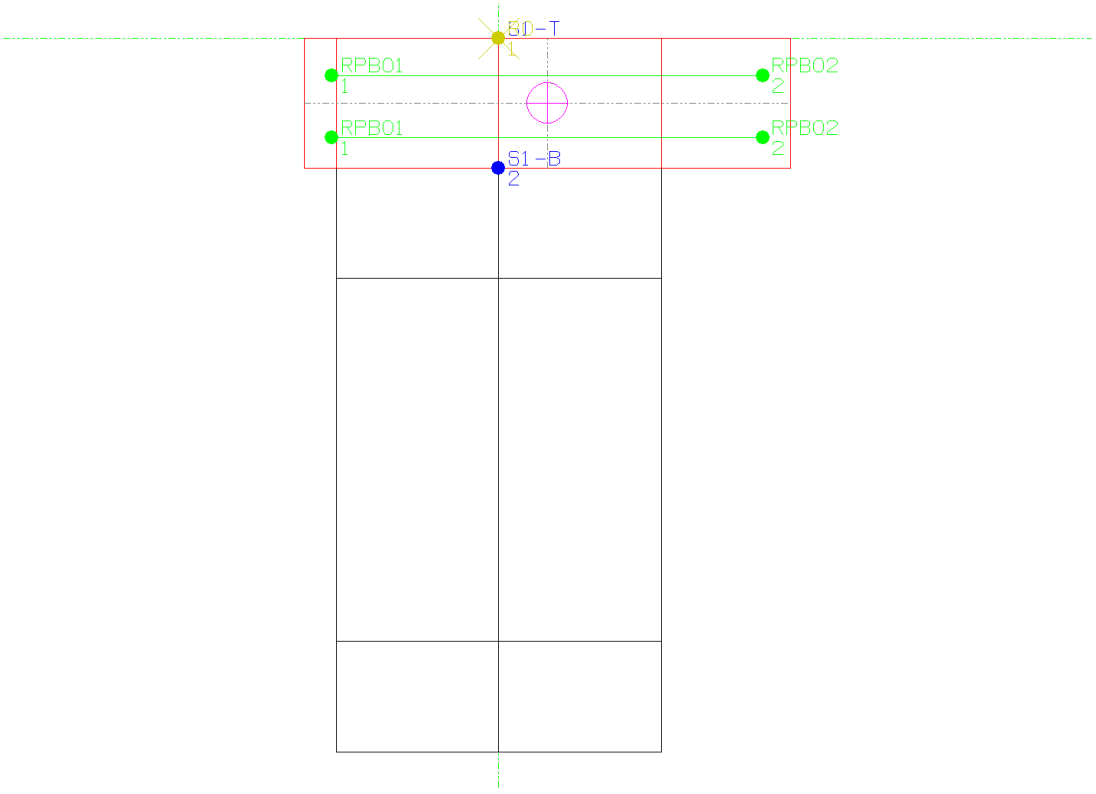
EPS	SIG (kN/m2)	Delt-L	Delt-R	Delt-inp

Cross-section : S01.01:001:1

Part : 1 Variant : 1

Reference set : All

Description : ID(I-900)



C R O S S - S E C T I O N D A T A

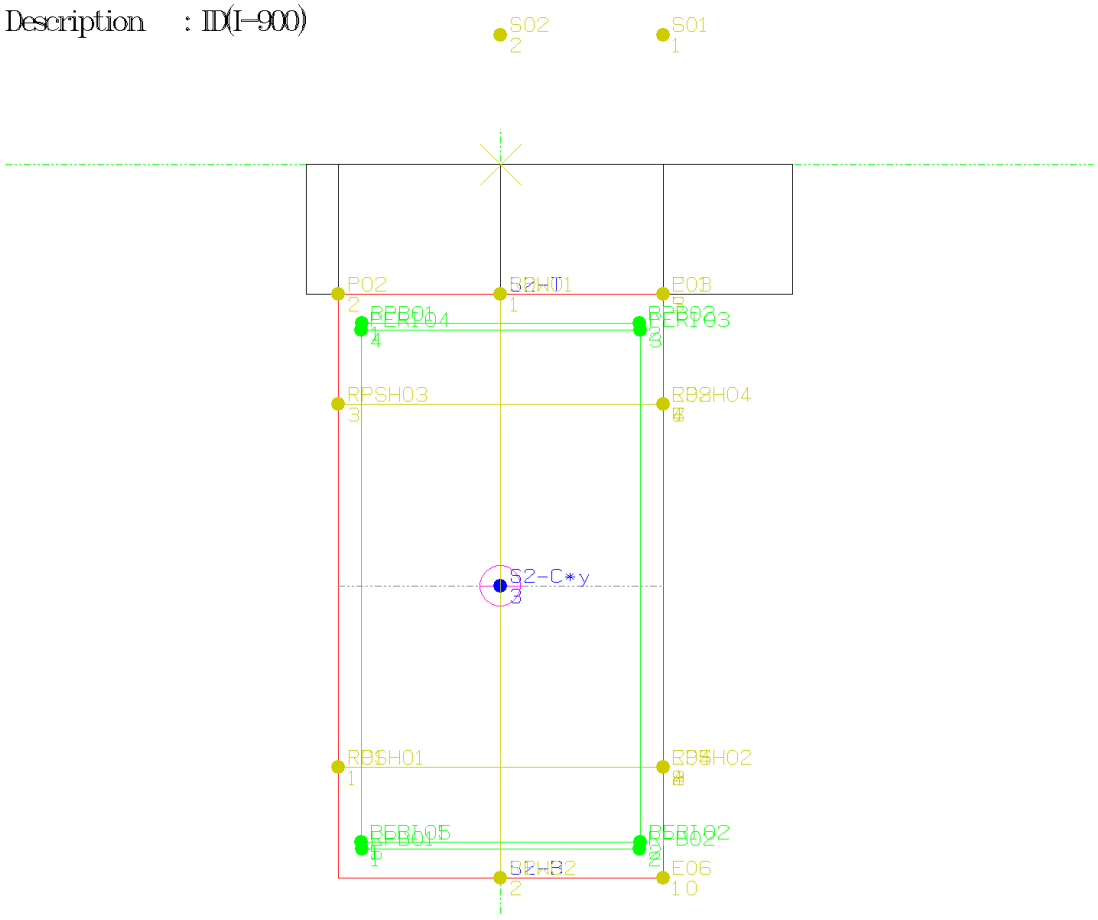
Cross-section area	0.15000E+00	m2
Shear area - Bending about Z-axis	0.15000E+00	m2
Shear area - Bending about Y-axis	0.12520E+00	m2
Torsional moment of inertia I	0.17008E-02	m4
Shear lag factor X (Ax-shear/Ax)	0.10000E+01	
Moment of inertia about Y-axis	0.70313E-02	m4
Section moment about Y-axis - min	0.18750E-01	m3
Section moment about Y-axis - max	0.18750E-01	m3
Eccentricity Z (Shear lag)	0.00000E+00	m
Shear lag factor Y	0.10000E+01	
Moment of inertia about Y-axis (Shear lag)	0.70313E-02	m4
Moment of inertia about Z-axis	0.50000E-03	m4
Section moment about Z-axis - min	0.50000E-02	m3
Section moment about Z-axis - max	0.50000E-02	m3
Eccentricity Y (Shear lag)	0.00000E+00	m
Shear lag factor Z	0.10000E+01	
Moment of inertia about Z-axis (Shear lag)	0.50000E-03	m4
Warping moment of inertia	0.18299E-04	m6
Bending axis origin - Eccentricity ey	-0.10000	m
Bending axis origin - Eccentricity ez	0.07500	m
Main axis angle	0.00000	Deg
Shear axis origin - Eccentricity ey	-0.10000	m
Shear axis origin - Eccentricity ez	0.07500	m
Main axis angle - Shear	0.00000	Deg
Y-below : Gravity centre - minY	0.10000	m
Y-above : Gravity centre - maxY	0.10000	m
Z-left : Gravity centre - minZ	0.37500	m
Z-right : Gravity centre - maxZ	0.37500	m
Perimeter exposed to drying (outside)	1.90000	m
Perimeter (inside)	0.00000	m

Cross-section : S01.01:0012

Part : 2 Variant : 1

Reference set : All

Description : ID(I-900)



C R O S S - S E C T I O N D A T A

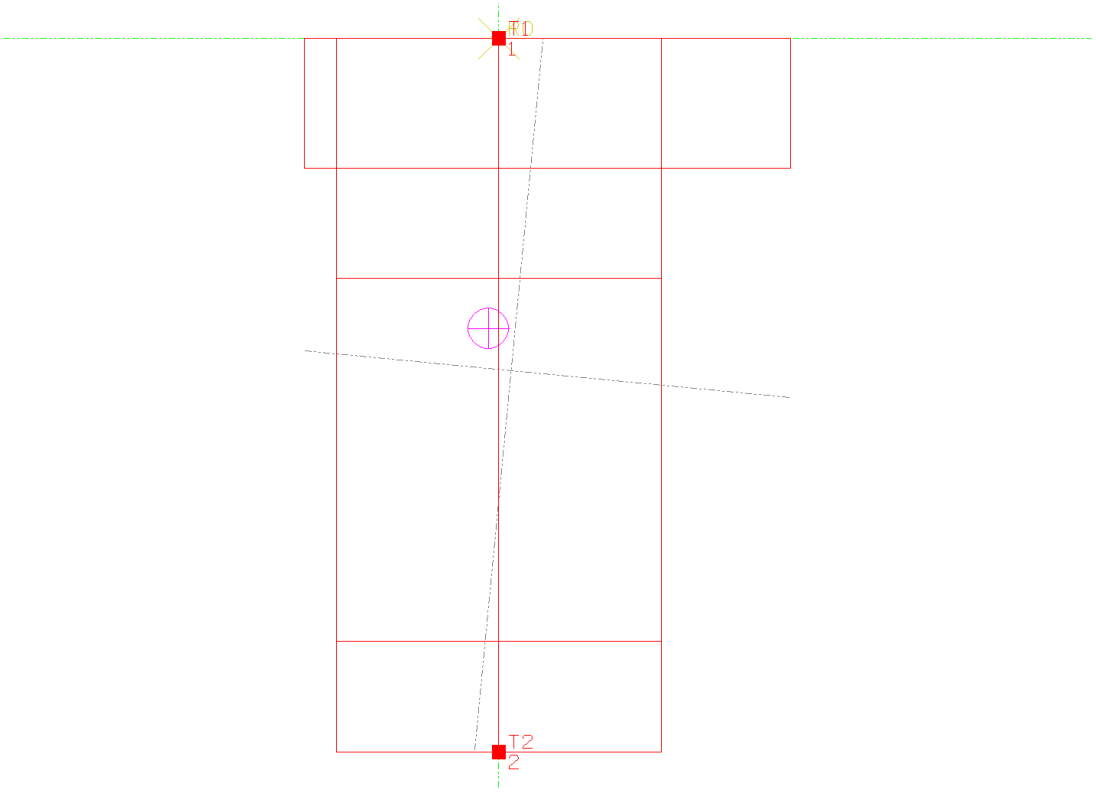
Cross-section area	0.45000E+00	m2
Shear area - Bending about Z-axis	0.38095E+00	m2
Shear area - Bending about Y-axis	0.37895E+00	m2
Torsional moment of inertia I	0.24682E-01	m4
Shear lag factor X (Ax-shear/Ax)	0.10000E+01	
Moment of inertia about Y-axis	0.93750E-02	m4
Section moment about Y-axis - min	0.37500E-01	m3
Section moment about Y-axis - max	0.37500E-01	m3
Eccentricity Z (Shear lag)	0.00000E+00	m
Shear lag factor Y	0.10000E+01	
Moment of inertia about Y-axis (Shear lag)	0.93750E-02	m4
Moment of inertia about Z-axis	0.30375E-01	m4
Section moment about Z-axis - min	0.67500E-01	m3
Section moment about Z-axis - max	0.67500E-01	m3
Eccentricity Y (Shear lag)	0.00000E+00	m
Shear lag factor Z	0.10000E+01	
Moment of inertia about Z-axis (Shear lag)	0.30375E-01	m4
Warping moment of inertia	0.18145E-03	m6
Bending axis origin - Eccentricity ey	-0.65000	m
Bending axis origin - Eccentricity ez	-0.00000	m
Main axis angle	0.00000	Deg
Shear axis origin - Eccentricity ey	-0.65000	m
Shear axis origin - Eccentricity ez	-0.00000	m
Main axis angle - Shear	0.00000	Deg
Y-below : Gravity centre - minY	0.45000	m
Y-above : Gravity centre - maxY	0.45000	m
Z-left : Gravity centre - minZ	0.25000	m
Z-right : Gravity centre - maxZ	0.25000	m
Perimeter exposed to drying (outside)	2.80000	m
Perimeter (inside)	0.00000	m

Cross-section : S01.01:001:3

Part : 3 Variant : 1

Reference set : All

Description : ID(I-900)



C R O S S - S E C T I O N D A T A

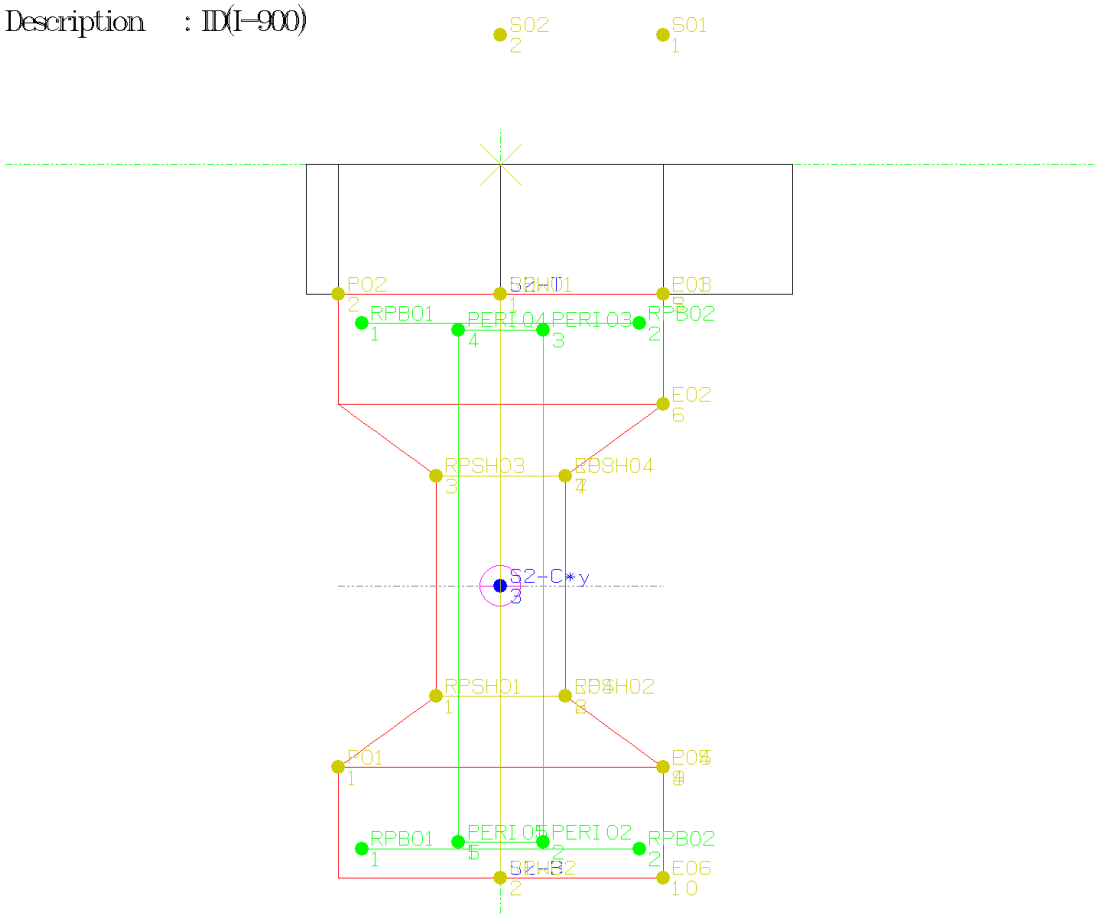
Cross-section area	0.60000E+00	m2
Shear area - Bending about Z-axis	0.46296E+00	m2
Shear area - Bending about Y-axis	0.45336E+00	m2
Torsional moment of inertia I	0.34568E-01	m4
Shear lag factor X (Ax-shear/Ax)	0.10000E+01	
Moment of inertia about Y-axis	0.17039E-01	m4
Section moment about Y-axis - min	0.53456E-01	m3
Section moment about Y-axis - max	0.39511E-01	m3
Eccentricity Z (Shear lag)	0.00000E+00	m
Shear lag factor Y	0.10000E+01	
Moment of inertia about Y-axis (Shear lag)	0.17039E-01	m4
Moment of inertia about Z-axis	0.64906E-01	m4
Section moment about Z-axis - min	0.11048E+00	m3
Section moment about Z-axis - max	0.12665E+00	m3
Eccentricity Y (Shear lag)	0.00000E+00	m
Shear lag factor Z	0.10000E+01	
Moment of inertia about Z-axis (Shear lag)	0.64906E-01	m4
Warping moment of inertia	0.90327E-03	m6
Bending axis origin - Eccentricity ey	-0.51250	m
Bending axis origin - Eccentricity ez	0.01875	m
Main axis angle	-5.48663	Deg
Shear axis origin - Eccentricity ey	-0.44692	m
Shear axis origin - Eccentricity ez	-0.01536	m
Main axis angle - Shear	0.00000	Deg
Y-below : Gravity centre - minY	0.58750	m
Y-above : Gravity centre - maxY	0.51250	m
Z-left : Gravity centre - minZ	0.31875	m
Z-right : Gravity centre - maxZ	0.43125	m
Perimeter exposed to drying (outside)	3.70000	m
Perimeter (inside)	0.00000	m

Cross-section : S01.01:003:2

Part : 2 Variant : 1

Reference set : All

Description : ID(I-900)



C R O S S - S E C T I O N D A T A

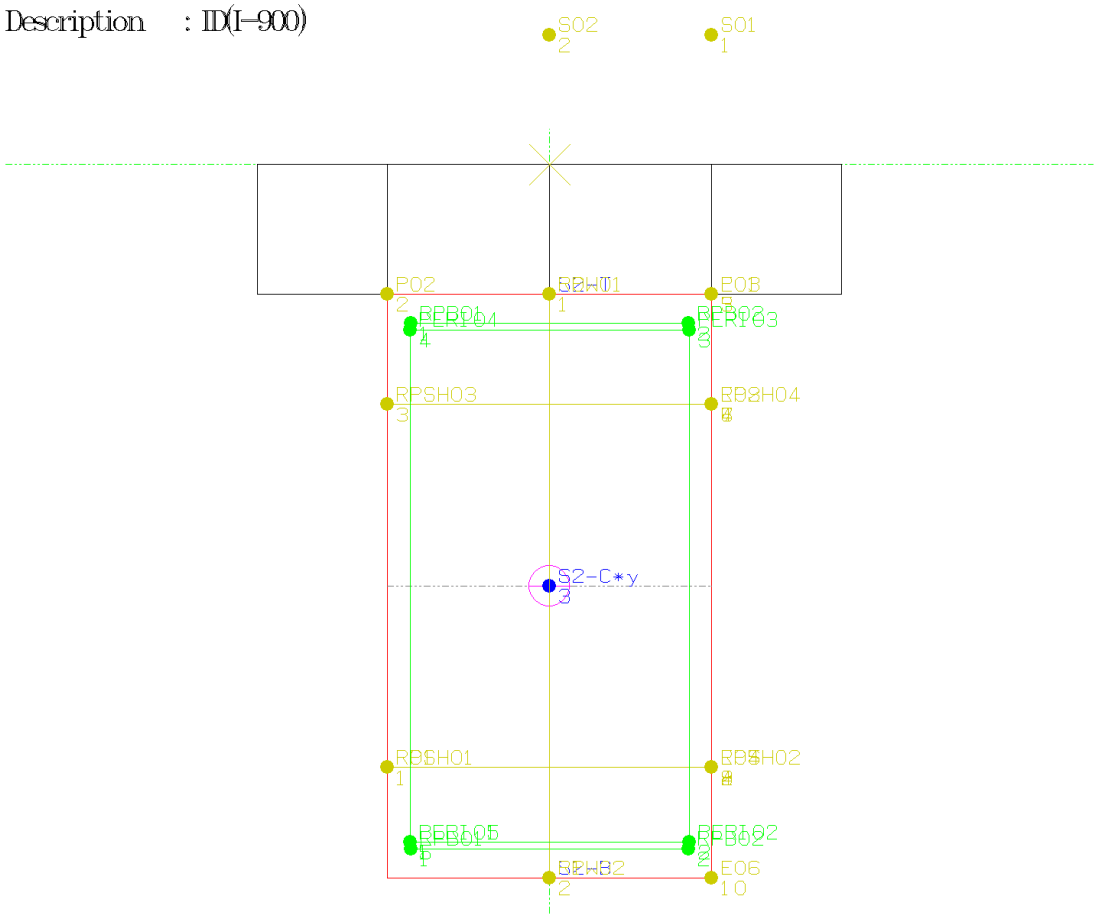
Cross-section area	0.31500E+00	m2
Shear area - Bending about Z-axis	0.17629E+00	m2
Shear area - Bending about Y-axis	0.24152E+00	m2
Torsional moment of inertia I	0.60187E-02	m4
Shear lag factor X (Ax-shear/Ax)	0.10000E+01	
Moment of inertia about Y-axis	0.46988E-02	m4
Section moment about Y-axis - min	0.18795E-01	m3
Section moment about Y-axis - max	0.18795E-01	m3
Eccentricity Z (Shear lag)	0.00000E+00	m
Shear lag factor Y	0.10000E+01	
Moment of inertia about Y-axis (Shear lag)	0.46988E-02	m4
Moment of inertia about Z-axis	0.27961E-01	m4
Section moment about Z-axis - min	0.62135E-01	m3
Section moment about Z-axis - max	0.62135E-01	m3
Eccentricity Y (Shear lag)	0.00000E+00	m
Shear lag factor Z	0.10000E+01	
Moment of inertia about Z-axis (Shear lag)	0.27961E-01	m4
Warping moment of inertia	0.37643E-03	m6
Bending axis origin - Eccentricity ey	-0.65000	m
Bending axis origin - Eccentricity ez	-0.00000	m
Main axis angle	0.00000	Deg
Shear axis origin - Eccentricity ey	-0.65000	m
Shear axis origin - Eccentricity ez	-0.00000	m
Main axis angle - Shear	0.00000	Deg
Y-below : Gravity centre - minY	0.45000	m
Y-above : Gravity centre - maxY	0.45000	m
Z-left : Gravity centre - minZ	0.25000	m
Z-right : Gravity centre - maxZ	0.25000	m
Perimeter exposed to drying (outside)	3.10404	m
Perimeter (inside)	0.00000	m

Cross-section : S01.02.0022

Part : 2 Variant : 1

Reference set : All

Description : ID(I-900)



C R O S S - S E C T I O N D A T A

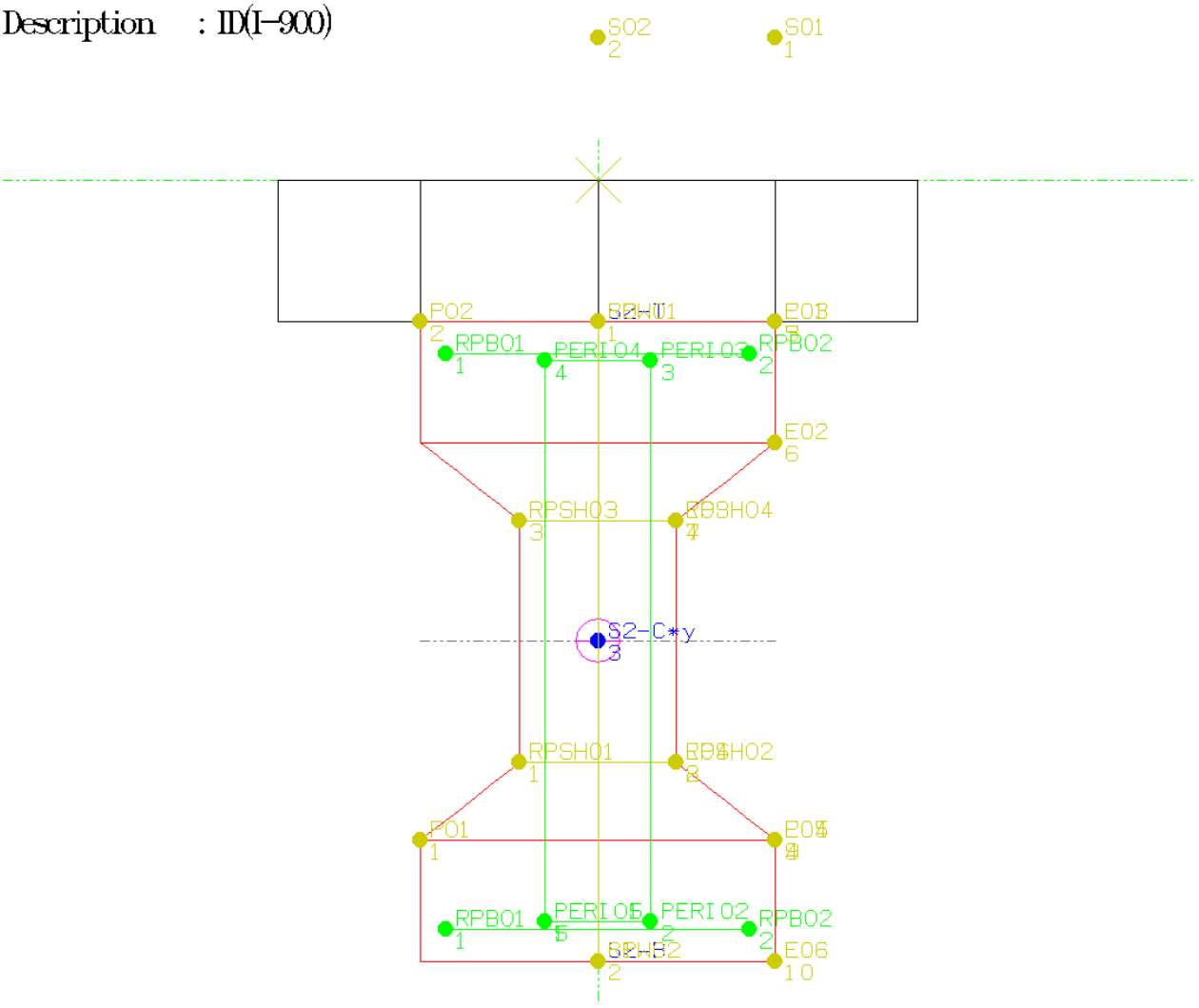
Cross-section area	0.45000E+00 m2
Shear area - Bending about Z-axis	0.38095E+00 m2
Shear area - Bending about Y-axis	0.37895E+00 m2
Torsional moment of inertia I	0.24682E-01 m4
Shear lag factor X (Ax-shear/Ax)	0.10000E+01
Moment of inertia about Y-axis	0.93750E-02 m4
Section moment about Y-axis - min	0.37500E-01 m3
Section moment about Y-axis - max	0.37500E-01 m3
Eccentricity Z (Shear lag)	0.00000E+00 m
Shear lag factor Y	0.10000E+01
Moment of inertia about Y-axis (Shear lag)	0.93750E-02 m4
Moment of inertia about Z-axis	0.30375E-01 m4
Section moment about Z-axis - min	0.67500E-01 m3
Section moment about Z-axis - max	0.67500E-01 m3
Eccentricity Y (Shear lag)	0.00000E+00 m
Shear lag factor Z	0.10000E+01
Moment of inertia about Z-axis (Shear lag)	0.30375E-01 m4
Warping moment of inertia	0.18145E-03 m6
Bending axis origin - Eccentricity ey	-0.65000 m
Bending axis origin - Eccentricity ez	-0.00000 m
Main axis angle	0.00000 Deg
Shear axis origin - Eccentricity ey	-0.65000 m
Shear axis origin - Eccentricity ez	-0.00000 m
Main axis angle - Shear	0.00000 Deg
Y-below : Gravity centre - minY	0.45000 m
Y-above : Gravity centre - maxY	0.45000 m
Z-left : Gravity centre - minZ	0.25000 m
Z-right : Gravity centre - maxZ	0.25000 m
Perimeter exposed to drying (outside)	2.80000 m
Perimeter (inside)	0.00000 m

Cross-section : S01.02.0042

Part : 2 Variant : 1

Reference set : All

Description : ID(I-900)



C R O S S - S E C T I O N D A T A

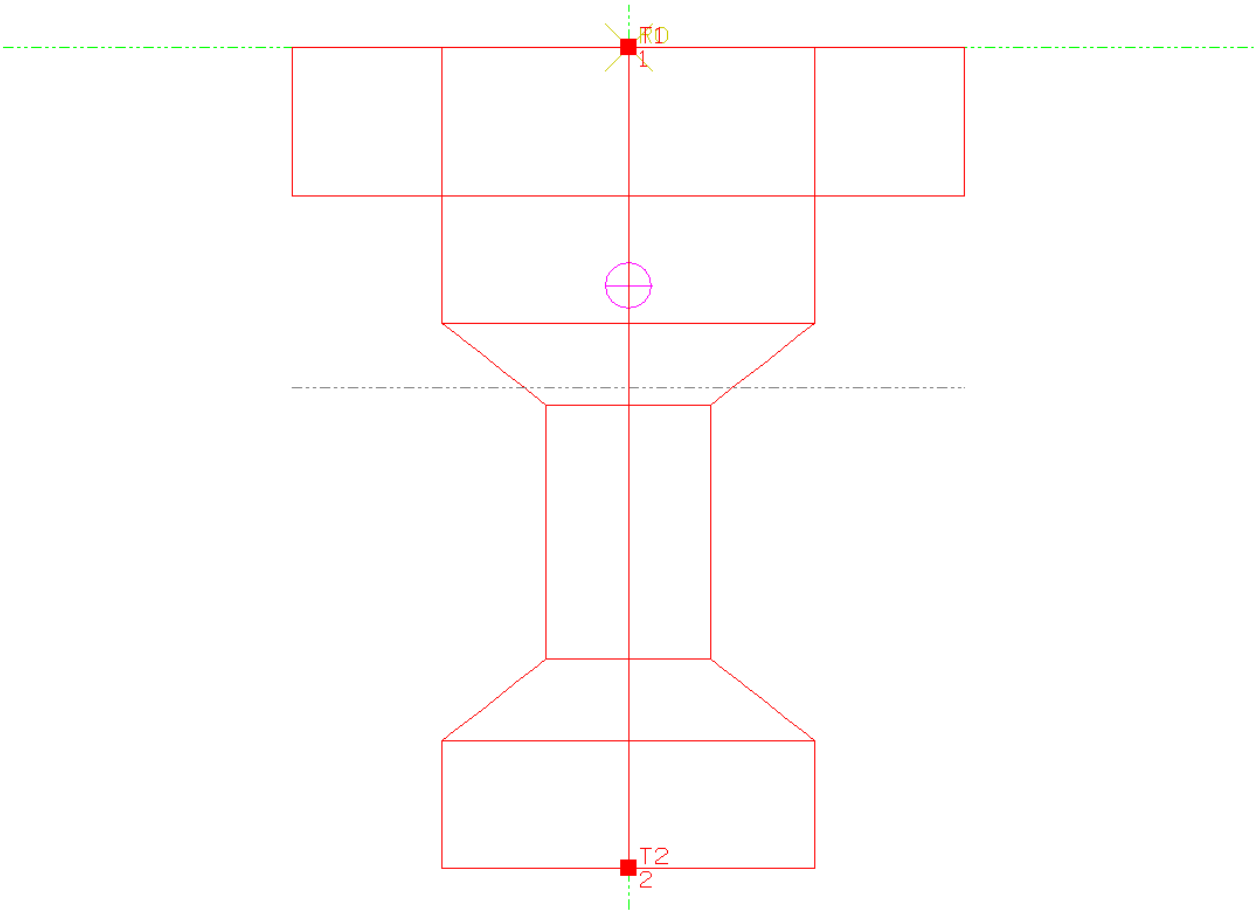
Cross-section area	0.32400E+00 m2
Shear area - Bending about Z-axis	0.19091E+00 m2
Shear area - Bending about Y-axis	0.25033E+00 m2
Torsional moment of inertia I	0.66814E-02 m4
Shear lag factor X (Ax-shear/Ax)	0.10000E+01
Moment of inertia about Y-axis	0.48281E-02 m4
Section moment about Y-axis - min	0.19312E-01 m3
Section moment about Y-axis - max	0.19312E-01 m3
Eccentricity Z (Shear lag)	0.00000E+00 m
Shear lag factor Y	0.10000E+01
Moment of inertia about Y-axis (Shear lag)	0.48281E-02 m4
Moment of inertia about Z-axis	0.28122E-01 m4
Section moment about Z-axis - min	0.62493E-01 m3
Section moment about Z-axis - max	0.62493E-01 m3
Eccentricity Y (Shear lag)	0.00000E+00 m
Shear lag factor Z	0.10000E+01
Moment of inertia about Z-axis (Shear lag)	0.28122E-01 m4
Warping moment of inertia	0.36759E-03 m6
Bending axis origin - Eccentricity ey	-0.65000 m
Bending axis origin - Eccentricity ez	-0.00000 m
Main axis angle	0.00000 Deg
Shear axis origin - Eccentricity ey	-0.65000 m
Shear axis origin - Eccentricity ez	0.00000 m
Main axis angle - Shear	0.00000 Deg
Y-below : Gravity centre - minY	0.45000 m
Y-above : Gravity centre - maxY	0.45000 m
Z-left : Gravity centre - minZ	0.25000 m
Z-right : Gravity centre - maxZ	0.25000 m
Perimeter exposed to drying (outside)	3.07218 m
Perimeter (inside)	0.00000 m

Cross-section : S01020043

Part : 3 Variant : 1

Reference set : All

Description : ID(I-900)



C R O S S - S E C T I O N D A T A

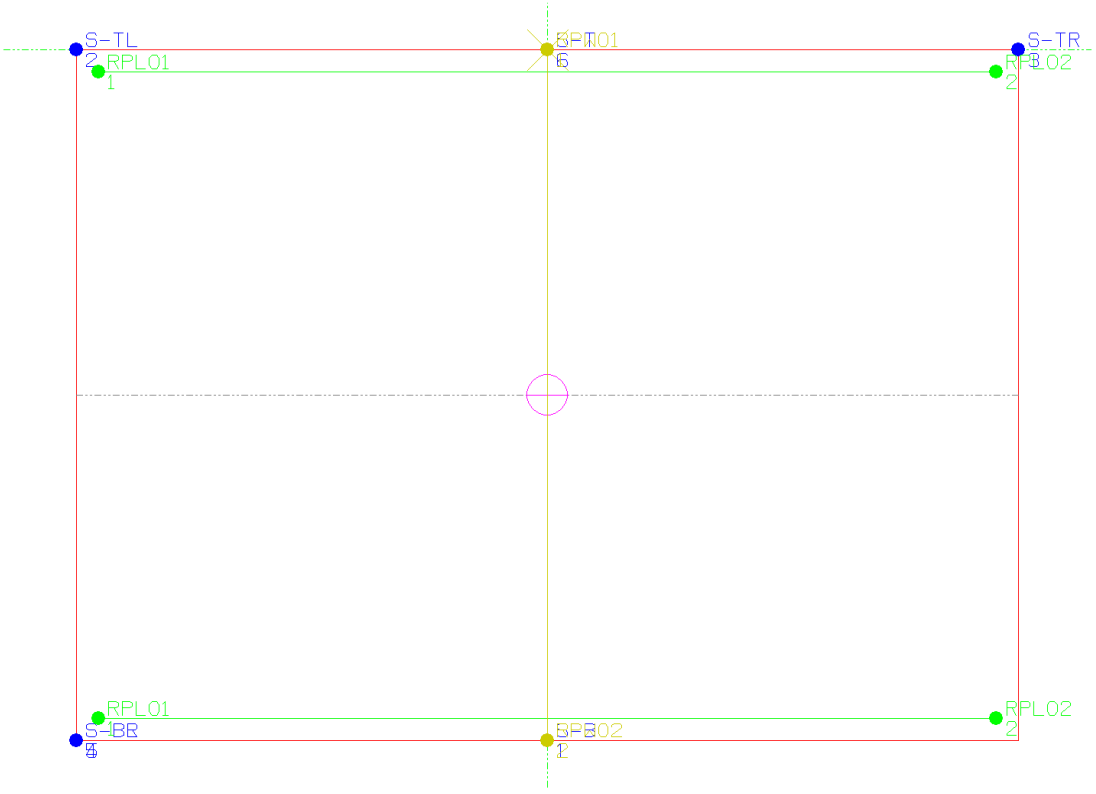
Cross-section area	0.51326E+00	m2
Shear area - Bending about Z-axis	0.27161E+00	m2
Shear area - Bending about Y-axis	0.32693E+00	m2
Torsional moment of inertia I	0.14929E-01	m4
Shear lag factor X (Ax-shear/Ax)	0.10000E+01	
Moment of inertia about Y-axis	0.17116E-01	m4
Section moment about Y-axis - min	0.38036E-01	m3
Section moment about Y-axis - max	0.38036E-01	m3
Eccentricity Z (Shear lag)	0.00000E+00	m
Shear lag factor Y	0.10000E+01	
Moment of inertia about Y-axis (Shear lag)	0.17116E-01	m4
Moment of inertia about Z-axis	0.64879E-01	m4
Section moment about Z-axis - min	0.10092E+00	m3
Section moment about Z-axis - max	0.14193E+00	m3
Eccentricity Y (Shear lag)	0.00000E+00	m
Shear lag factor Z	0.10000E+01	
Moment of inertia about Z-axis (Shear lag)	0.64879E-01	m4
Warping moment of inertia	0.11082E-02	m6
Bending axis origin - Eccentricity ey	-0.45711	m
Bending axis origin - Eccentricity ez	-0.00000	m
Main axis angle	0.00000	Deg
Shear axis origin - Eccentricity ey	-0.32034	m
Shear axis origin - Eccentricity ez	0.00000	m
Main axis angle - Shear	0.00000	Deg
Y-below : Gravity centre - minY	0.64289	m
Y-above : Gravity centre - maxY	0.45711	m
Z-left : Gravity centre - minZ	0.45000	m
Z-right : Gravity centre - maxZ	0.45000	m
Perimeter exposed to drying (outside)	4.27218	m
Perimeter (inside)	0.00000	m

Cross-section : CGirder:001

Part : 1 Variant : 1

Reference set : All

Description : CGirder



C R O S S - S E C T I O N D A T A

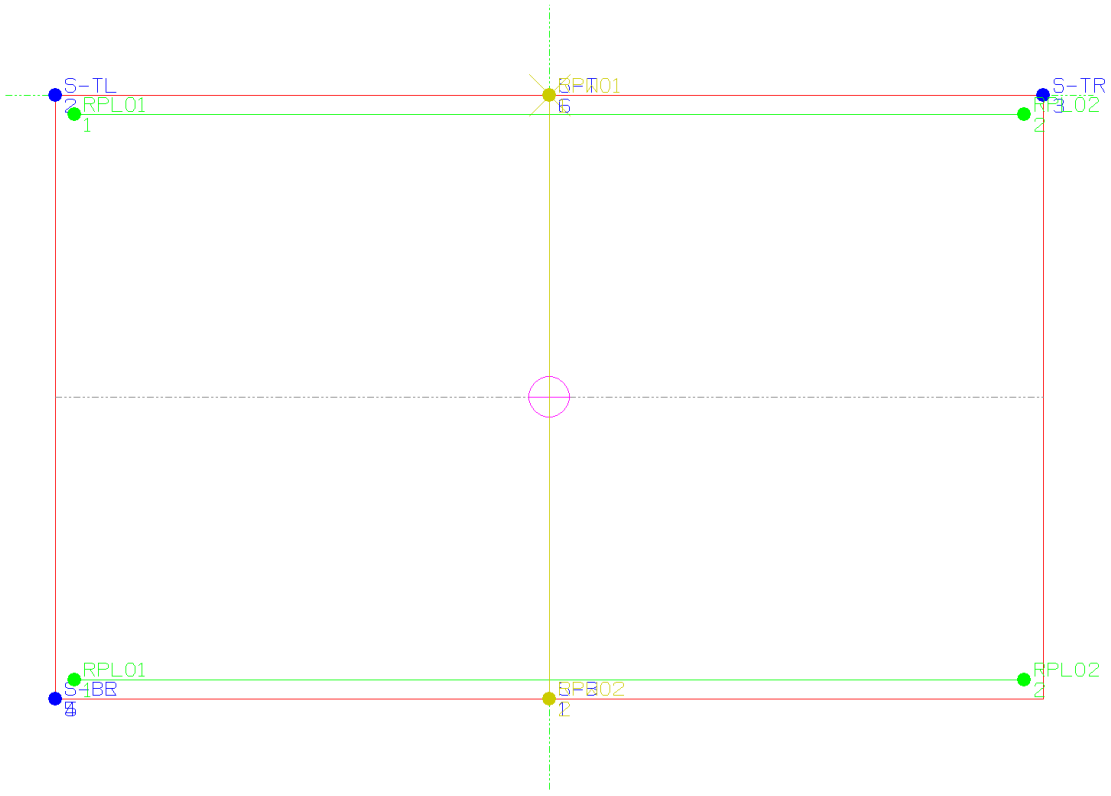
Cross-section area	0.16500E+01	m2
Shear area - Bending about Z-axis	0.16500E+01	m2
Shear area - Bending about Y-axis	0.16500E+01	m2
Torsional moment of inertia I	0.43277E+00	m4
Shear lag factor X (Ax-shear/Ax)	0.10000E+01	
Moment of inertia about Y-axis	0.30938E+00	m4
Section moment about Y-axis - min	0.41250E+00	m3
Section moment about Y-axis - max	0.41250E+00	m3
Eccentricity Z (Shear lag)	0.00000E+00	m
Shear lag factor Y	0.10000E+01	
Moment of inertia about Y-axis (Shear lag)	0.30938E+00	m4
Moment of inertia about Z-axis	0.16637E+00	m4
Section moment about Z-axis - min	0.30250E+00	m3
Section moment about Z-axis - max	0.30250E+00	m3
Eccentricity Y (Shear lag)	0.00000E+00	m
Shear lag factor Z	0.10000E+01	
Moment of inertia about Z-axis (Shear lag)	0.16637E+00	m4
Warping moment of inertia	0.28184E-02	m6
Bending axis origin - Eccentricity ey	-0.55000	m
Bending axis origin - Eccentricity ez	0.00000	m
Main axis angle	0.00000	Deg
Shear axis origin - Eccentricity ey	-0.55000	m
Shear axis origin - Eccentricity ez	0.00000	m
Main axis angle - Shear	0.00000	Deg
Y-below : Gravity centre - minY	0.55000	m
Y-above : Gravity centre - maxY	0.55000	m
Z-left : Gravity centre - minZ	0.75000	m
Z-right : Gravity centre - maxZ	0.75000	m
Perimeter exposed to drying (outside)	5.20000	m
Perimeter (inside)	0.00000	m

Cross-section : CGirder:002

Part : 1 Variant : 1

Reference set : All

Description : CGirder



C R O S S - S E C T I O N D A T A

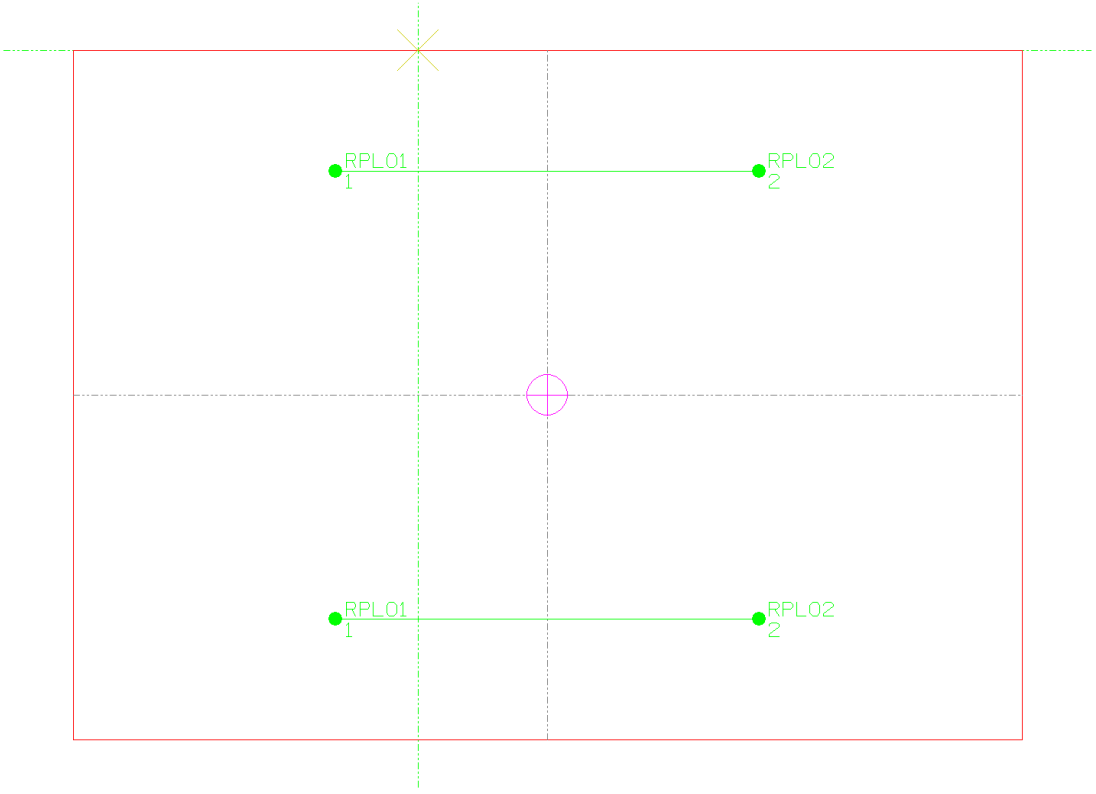
Cross-section area	0.19800E+01	m2
Shear area - Bending about Z-axis	0.19800E+01	m2
Shear area - Bending about Y-axis	0.19800E+01	m2
Torsional moment of inertia I	0.58145E+00	m4
Shear lag factor X (Ax-shear/Ax)	0.10000E+01	
Moment of inertia about Y-axis	0.53460E+00	m4
Section moment about Y-axis - min	0.59400E+00	m3
Section moment about Y-axis - max	0.59400E+00	m3
Eccentricity Z (Shear lag)	0.00000E+00	m
Shear lag factor Y	0.10000E+01	
Moment of inertia about Y-axis (Shear lag)	0.53460E+00	m4
Moment of inertia about Z-axis	0.19965E+00	m4
Section moment about Z-axis - min	0.36300E+00	m3
Section moment about Z-axis - max	0.36300E+00	m3
Eccentricity Y (Shear lag)	0.00000E+00	m
Shear lag factor Z	0.10000E+01	
Moment of inertia about Z-axis (Shear lag)	0.19965E+00	m4
Warping moment of inertia	0.11218E-01	m6
Bending axis origin - Eccentricity ey	-0.55000	m
Bending axis origin - Eccentricity ez	-0.00000	m
Main axis angle	0.00000	Deg
Shear axis origin - Eccentricity ey	-0.55000	m
Shear axis origin - Eccentricity ez	-0.00000	m
Main axis angle - Shear	0.00000	Deg
Y-below : Gravity centre - minY	0.55000	m
Y-above : Gravity centre - maxY	0.55000	m
Z-left : Gravity centre - minZ	0.90000	m
Z-right : Gravity centre - maxZ	0.90000	m
Perimeter exposed to drying (outside)	5.80000	m
Perimeter (inside)	0.00000	m

Cross-section : Cbeam002

Part : 1 Variant : 1

Reference set : All

Description : Cbeam



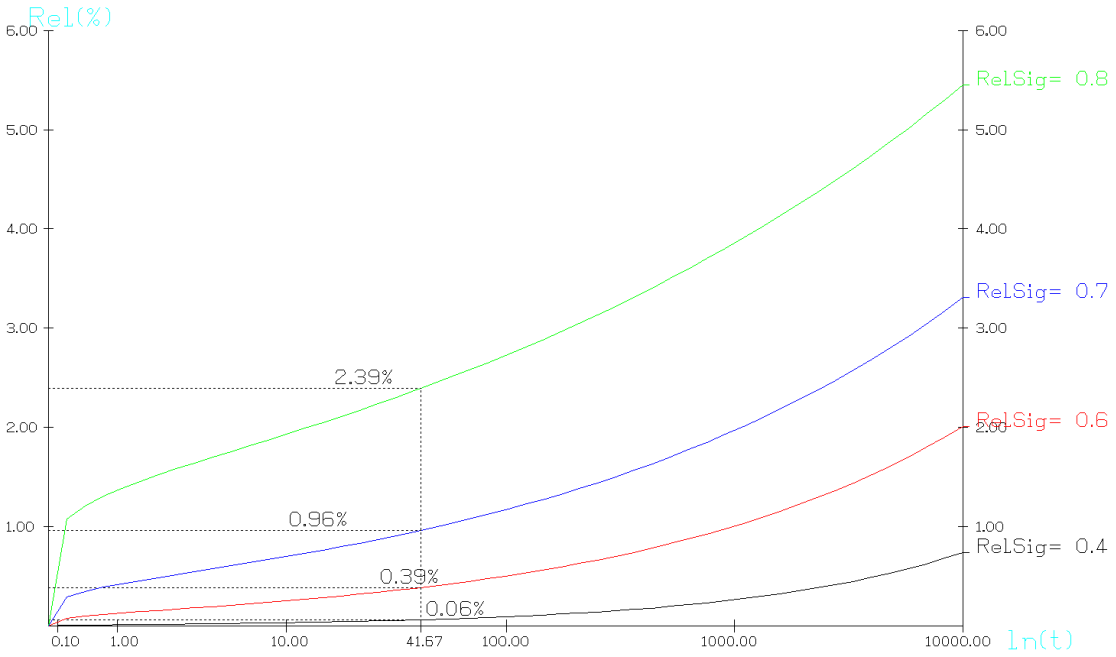
C R O S S - S E C T I O N D A T A

Cross-section area	0.55000E-01	m2
Shear area - Bending about Z-axis	0.55000E-01	m2
Shear area - Bending about Y-axis	0.55000E-01	m2
Torsional moment of inertia I	0.47964E-03	m4
Shear lag factor X (Ax-shear/Ax)	0.10000E+01	
Moment of inertia about Y-axis	0.34661E-03	m4
Section moment about Y-axis - min	0.25208E-02	m3
Section moment about Y-axis - max	0.25208E-02	m3
Eccentricity Z (Shear lag)	0.00000E+00	m
Shear lag factor Y	0.10000E+01	
Moment of inertia about Y-axis (Shear lag)	0.34661E-03	m4
Moment of inertia about Z-axis	0.18333E-03	m4
Section moment about Z-axis - min	0.18333E-02	m3
Section moment about Z-axis - max	0.18333E-02	m3
Eccentricity Y (Shear lag)	0.00000E+00	m
Shear lag factor Z	0.10000E+01	
Moment of inertia about Z-axis (Shear lag)	0.18333E-03	m4
Warping moment of inertia	0.10968E-06	m6
Bending axis origin - Eccentricity ey	-0.10000	m
Bending axis origin - Eccentricity ez	0.03750	m
Main axis angle	0.00000	Deg
Shear axis origin - Eccentricity ey	-0.10000	m
Shear axis origin - Eccentricity ez	0.03750	m
Main axis angle - Shear	0.00000	Deg
Y-below : Gravity centre - minY	0.10000	m
Y-above : Gravity centre - maxY	0.10000	m
Z-left : Gravity centre - minZ	0.13750	m
Z-right : Gravity centre - maxZ	0.13750	m
Perimeter exposed to drying (outside)	0.95000	m
Perimeter (inside)	0.00000	m

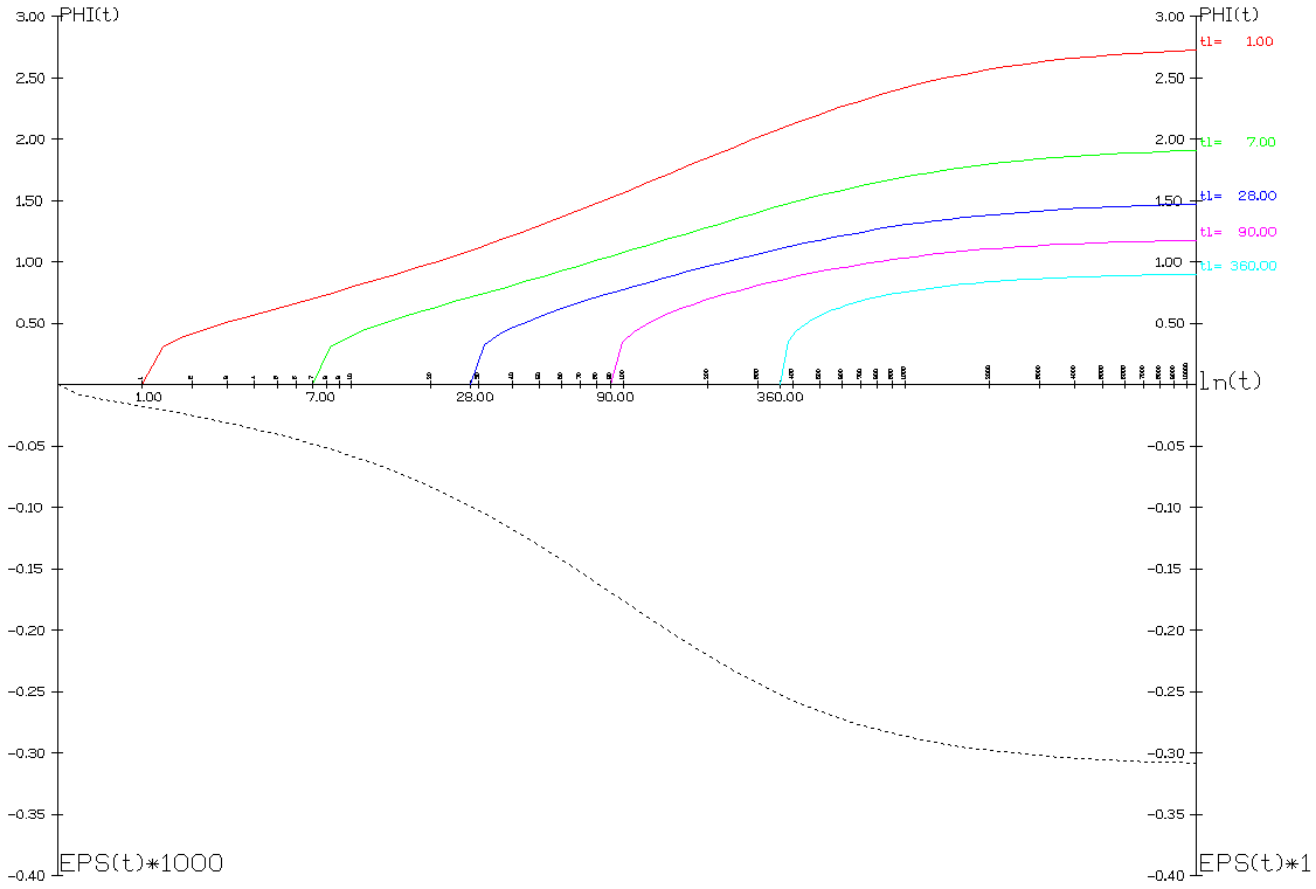
Eurocode 2

Relaxation curve

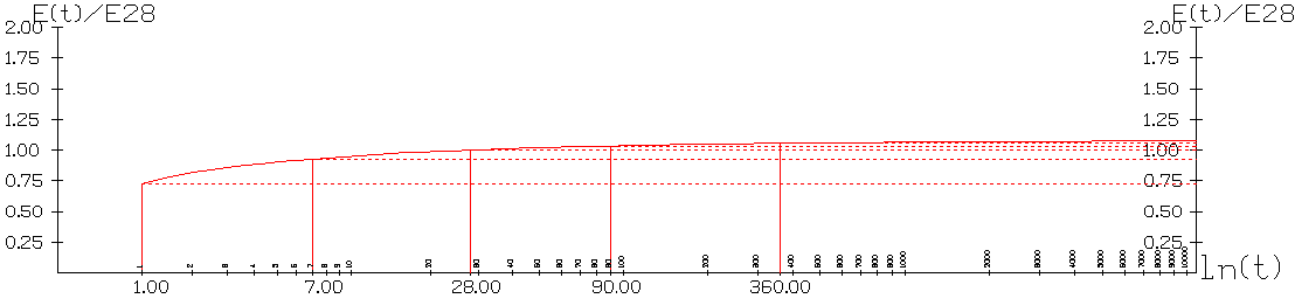
Tendon 111
RelCls = 2



Eurocode 2
Creep and Shrinkage curve
Element 10110



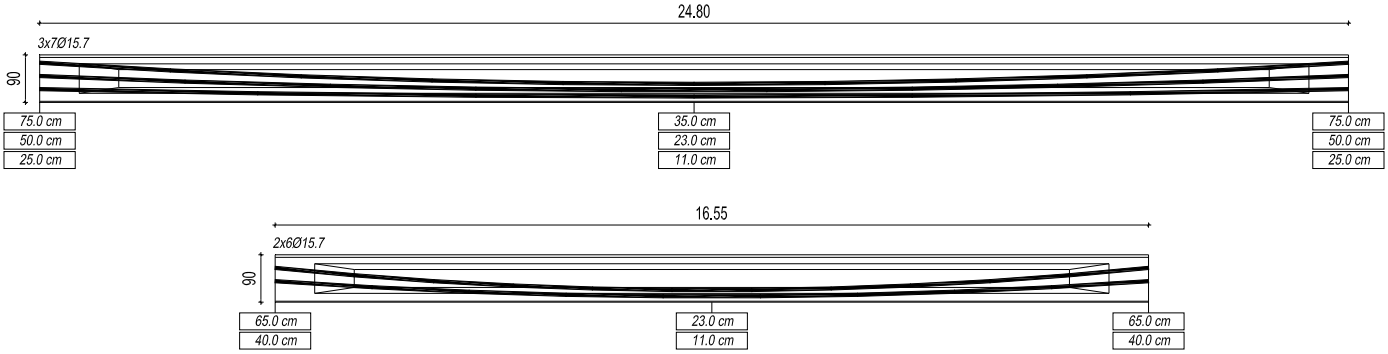
Eurocode 2
E-Modulus (t) curve
Element 10110



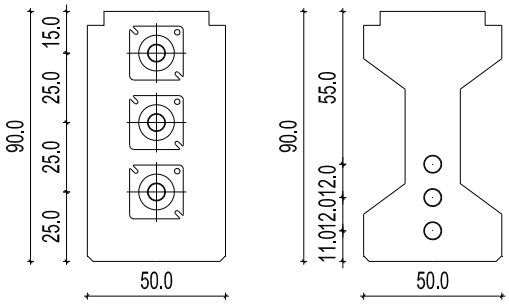
4.2. ГЕОМЕТРИЈА КАБЛОВА ЗА ПРЕДНАПРЕЗАЊЕ

PROFILE OF PRESTRESSING TENDONS

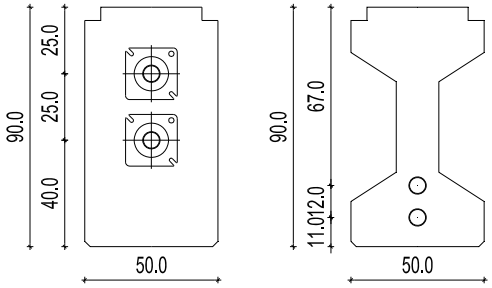
Траса каблова / cable layout



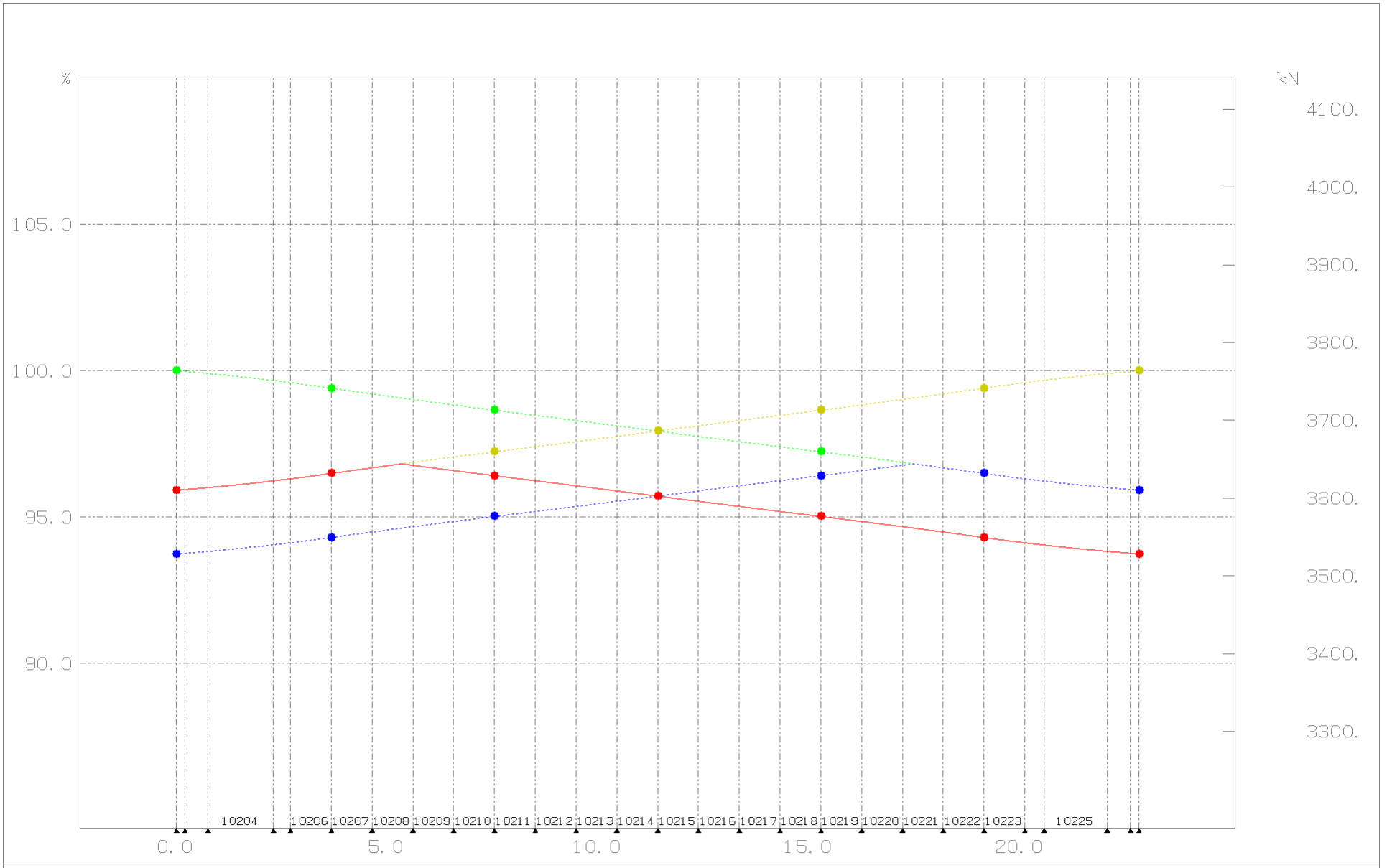
Попречни пресеци / Cross sections



L = 24.80 m

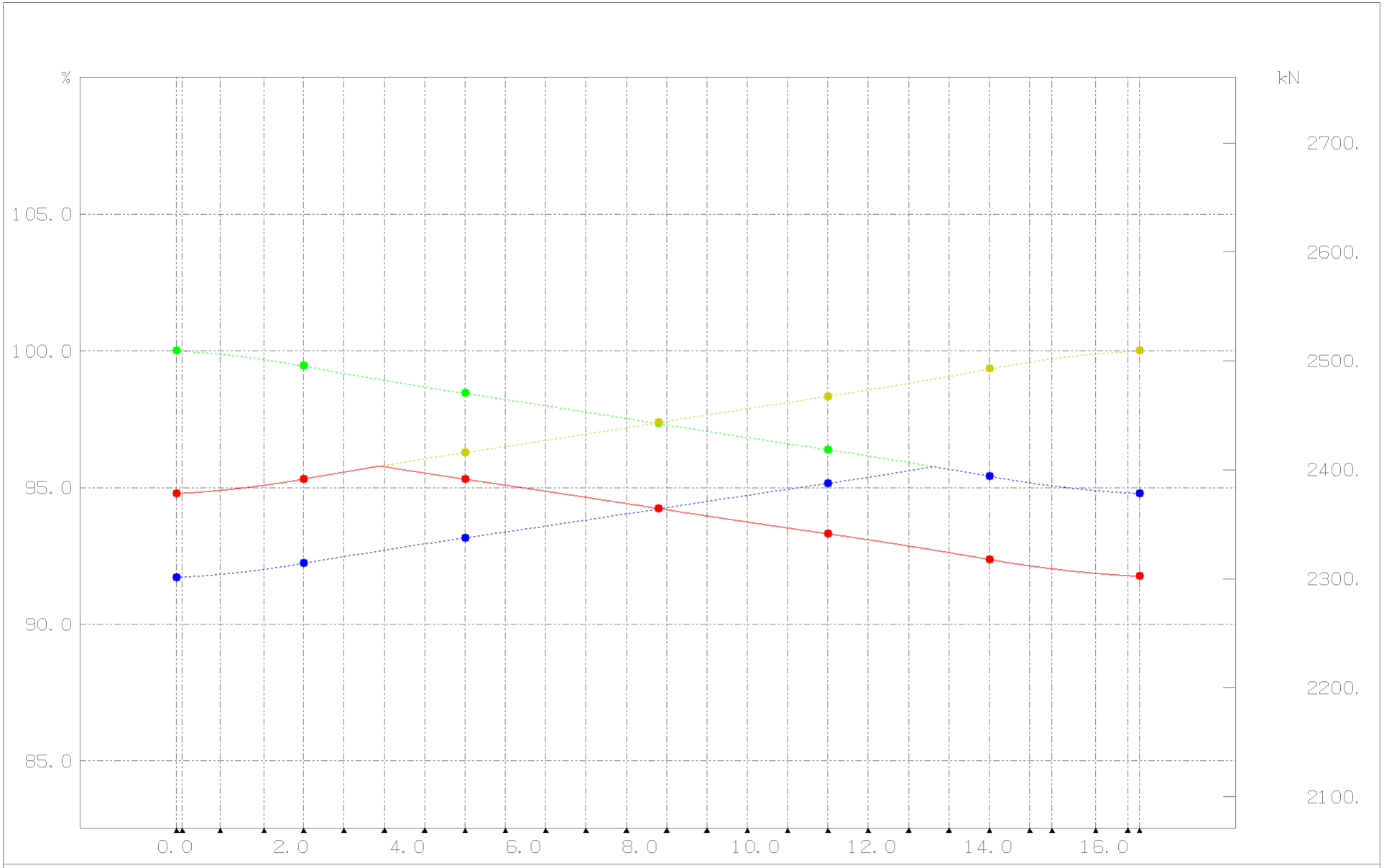


L = 16.55 m



Tendon pre-stressing – Normal force diagram
Tendon 211 Stress group SL1

sig_{allow} = 0.139E+07
A = 0.0009
N_{Tendon} = 3



Tendon pre-stressing – Normal force diagram
Tendon 111 Stress group SL1

sig_{allow} = 0.139E+07
A = 0.0009
N_{Tendon} = 2

TENDON No. : 111 Number of tendons : 2
Material : Strand-1640/1860

Tendon nominal area : +9.00000e-04
Tendon duct area : +2.82600e-03
Friction (my) : 0.22000
Wobble angle (Beta) : 0.30000
E-Modul - static : +1.95000e+08
E-Modul - prestress.: +1.95000e+08
Allow. stress : +1.39400e+06

Tendon	Action		Nb Nb%	Ne Ne%	dl	L
111	STRESS	START	1254.600 1.000	1189.078 0.948	0.11532	16.570
111	WEDGE SLIP	START	1150.587 0.917	1201.468 0.958	-0.00400	13.039
111	STRESS	END	1189.078 0.948	1254.600 1.000	0.00403	16.570
111	WEDGE SLIP	END	1201.757 0.958	1151.140 0.918	-0.00400	13.065

TENDON No. : 211 Number of tendons : 3
Material : Strand-1640/1860

Tendon nominal area : +9.00000e-04
Tendon duct area : +2.82600e-03
Friction (my) : 0.22000
Wobble angle (Beta) : 0.30000

Tendon	Action		Nb Nb%	Ne Ne%	dl	L
211	STRESS	START	1254.600 1.000	1203.393 0.959	0.15968	22.806
211	WEDGE SLIP	START	1176.094 0.937	1214.713 0.968	-0.00400	17.464
211	STRESS	END	1203.393 0.959	1254.600 1.000	0.00400	22.806
211	WEDGE SLIP	END	1214.713 0.968	1176.093 0.937	-0.00400	17.464

4.3. УЛАЗНИ ПОДАЦИ ЗА ПРОРАЧУН МОДЕЛА

STRUCTURAL ANALYSIS DATA INPUT

1 Material properties

Material Properties	C_30/37 (used)		
Group	EN_Eurocode		
Description	C_30/37 (prEN 1992-		
Type	CONCRETE		
Modulus of elasticity	Emod	33000000	KN/M2
Poisson's ratio	ny	0.20	-
Shear-Modulus	Gmod	13750000	KN/M2
Specific weight	Gamma	25.00	KN/M3
Coeff. of thermal expansion	AlphaT	1e-5	1/CELSIUS
Coefficient of concrete consistency (1-3)	CF	2	-
Degree of cement hardening (1-3)	HCF	2	-
Water cement ratio	(WCR)	0.4	-
Cement content in concrete	(CECO)	3	-
Characteristic compressive cylinder strength of concrete at	fck	3e4	KN/M2
Characteristic cube compressive strength of concrete at 28	fck,cube	37e3	KN/M2
Mean value of concrete compressive strength	fcm	38e3	KN/M2
Mean value of axial tensile strength of concrete	fctm	2900	KN/M2
Tension split strenght	fct	2030	KN/M2
Tension bending strenght	(TSB)	0	KN/M2

Stress limits		min	max	
	1	-18000.00	2900.00	KN/M2
	2	-13500.00	2900.00	KN/M2
	3	-18000.00	0.00	KN/M2

Material Properties	C_40/50 (used)		
Group	EN_Eurocode		
Description	C_40/50 (prEN 1992-		
Type	CONCRETE		
Modulus of elasticity	Emod	35000000	KN/M2
Poisson's ratio	ny	0.20	-
Shear-Modulus	Gmod	14583330	KN/M2
Specific weight	Gamma	25.00	KN/M3
Coeff. of thermal expansion	AlphaT	1e-5	1/CELSIUS
Coefficient of concrete consistency (1-3)	CF	2	-
Degree of cement hardening (1-3)	HCF	2	-
Water cement ratio	(WCR)	0.4	-
Cement content in concrete	(CECO)	3	-
Characteristic compressive cylinder strength of concrete at	fck	4e4	KN/M2
Characteristic cube compressive strength of concrete at 28	fck,cube	5e4	KN/M2
Mean value of concrete compressive strength	fcm	48e3	KN/M2
Mean value of axial tensile strength of concrete	fctm	3500	KN/M2
Tension split strenght	fct	2450	KN/M2
Tension bending strenght	(TSB)	0	KN/M2

Stress limits		min	max	
	1	-24000.00	3500.00	KN/M2
	2	-18000.00	3500.00	KN/M2
	3	-24000.00	0.00	KN/M2

Material Properties	C_45/55 (used)

Group	EN_Eurocode		
Description	C_45/55 (prEN 1992-		
Type	CONCRETE		

Modulus of elasticity	Emod	36000000	KN/M2
Poisson's ratio	ny	0.20	-
Shear-Modulus	Gmod	15000000	KN/M2
Specific weight	Gamma	25.00	KN/M3
Coeff. of thermal expansion	AlphaT	1e-5	1/CELSIUS

Coefficient of concrete consistency (1-3)	CF	2	-
Degree of cement hardening (1-3)	HCF	2	-
Water cement ratio	(WCR)	0.4	-
Cement content in concrete	(CECO)	3	-

Characteristic compressive cylinder strength of concrete at	fck	45e3	KN/M2
Characteristic cube compressive strength of concrete at 28	fck,cube	55e3	KN/M2
Mean value of concrete compressive strength	fcm	53e3	KN/M2
Mean value of axial tensile strength of concrete	fctm	3800	KN/M2
Tension split strenght	fct	2660	KN/M2
Tension bending strenght	(TSB)	0	KN/M2

Stress limits		min	max	
	1	-27000.00	3800.00	KN/M2
	2	-20250.00	3800.00	KN/M2
	3	-27000.00	0.00	KN/M2

Material Properties	**Strand-1640/1860 (u**

Group	Default		
Description	Strand-1640/1860 (p		
Type	PRESTRESSING		

Modulus of elasticity	Emod	195000000	KN/M2
Poisson's ratio	ny	0.30	-
Shear-Modulus	Gmod	75000000	KN/M2
Specific weight	Gamma	78.50	KN/M3
Coeff. of thermal expansion	AlphaT	1e-5	1/CELSIUS

Tensile strength of prestressing steel	fpk	186e4	KN/M2
Design tensile strength of prestressing steel	fpd	1617391	KN/M2
Modulus of elasticity of prestressing steel	Ep	195e6	KN/M2
Stressing limit	SIGP	1394e3	KN/M2
Coeff. for prestr. type (smooth or profiled)	XI	0.5	-
Relaxation class	RELCL	2	-

2 Combinatio table

		Combinations					
LF/SUP	Rule	(+) / (-)	(+) / (-)	(+) / (-)	(+) / (-)	(+) / (-)	(+) / (-)
		Comb 1	Comb 2	Comb 3	Comb 4	Comb 5	Comb 6
Girder-SW	SupAddLc	1.00	1.00				
Precast-PT	SupAddLc	1.00	1.00				
Girder-CS	SupAddLc	1.00	1.00				
Precast-CS	SupAddLc	1.00	1.00				
Onsite-SW-01	SupAddLc		1.00				
SUM-SW	SupAddLc			1.00	1.00	1.00	1.00
SUM-PT	SupAddLc			1.00	1.00	0.90 / 1.10	0.90 / 1.10
SUM-SDL	SupAddLc			1.00	1.00	1.00	1.00
SUM-CSt0	SupAddLc			1.00	1.00	1.00	1.00
SUM-CStinf	SupAddLc			1.00			1.00
SUM-CStinf	SupAndLc				1.00		
LM1-TS.sup	SupAndSup				1.00	1.00	1.00
LM1-UDL.sup	SupAndSup				1.00	1.00	1.00
LM3-1.sup	SupAndSup						
Pedestrian.su	SupAndSup				1.00	1.00	1.00
Brake.sup	SupAndSup						
WindS-T.sup	SupAndSup						
WindS+T.sup	SupAndSup						
Temp.sup	SupAndSup				0.60	0.60	0.60
EQ.sup	SupAndSup						
		Girders	STG1-Onsite	Final	Characteristic	Characteristic	Characteristic

		Comb 7	Comb 8	Comb 9	Comb 10	Comb 11	Comb 12
Girder-SW	SupAddLc						
Precast-PT	SupAddLc						
Girder-CS	SupAddLc						
Precast-CS	SupAddLc						
Onsite-SW-01	SupAddLc						
SUM-SW	SupAddLc	1.00	1.00	1.00	1.00	1.00	1.00
SUM-PT	SupAddLc	0.90 / 1.10	0.90 / 1.10	0.90 / 1.10	0.90 / 1.10	0.90 / 1.10	0.90 / 1.10
SUM-SDL	SupAddLc	1.00	1.00	1.00	1.00	1.00	1.00
SUM-CSt0	SupAddLc	1.00	1.00	1.00	1.00	1.00	1.00
SUM-CStinf	SupAddLc		1.00		1.00		1.00
SUM-CStinf	SupAndLc						
LM1-TS.sup	SupAndSup	1.00	1.00	0.75	0.75	0.75	0.75
LM1-UDL.sup	SupAndSup	1.00	1.00	0.40	0.40	0.40	0.40
LM3-1.sup	SupAndSup						
Pedestrian.su	SupAndSup	1.00	1.00	0.40	0.40	0.40	0.40
Brake.sup	SupAndSup						
WindS-T.sup	SupAndSup						
WindS+T.sup	SupAndSup	0.60	0.60			1.00	1.00
Temp.sup	SupAndSup			1.00	1.00		
EQ.sup	SupAndSup						
		Characteristic	Characteristic	Characteristic	Characteristic	Characteristic	Characteristic

		Comb 13	Comb 14	Comb 15	Comb 16	Comb 17	Comb 18
Girder-SW	SupAddLc						
Precast-PT	SupAddLc						
Girder-CS	SupAddLc						
Precast-CS	SupAddLc						
Onsite-SW-01	SupAddLc						
SUM-SW	SupAddLc	1.00	1.00	1.00	1.00	1.00	1.00
SUM-PT	SupAddLc	0.90 / 1.10	0.90 / 1.10	0.90 / 1.10	0.90 / 1.10	0.90 / 1.10	0.90 / 1.10
SUM-SDL	SupAddLc	1.00	1.00	1.00	1.00	1.00	1.00
SUM-CSt0	SupAddLc	1.00	1.00	1.00	1.00	1.00	1.00
SUM-CStinf	SupAddLc		1.00		1.00		1.00
SUM-CStinf	SupAndLc						
LM1-TS.sup	SupAndSup			0.75	0.75	0.75	0.75
LM1-UDL.sup	SupAndSup			0.40	0.40	0.40	0.40
LM3-1.sup	SupAndSup						
Pedestrian.su	SupAndSup			0.40	0.40		

		Combinations					
LF/SUP	Rule	(+) / (-)	(+) / (-)	(+) / (-)	(+) / (-)	(+) / (-)	(+) / (-)
Brake.sup	SupAndSup			1.00	1.00		
WindS-T.sup	SupAndSup	1.00	1.00				
WindS+T.sup	SupAndSup						
Temp.sup	SupAndSup			0.60	0.60	0.50	0.50
EQ.sup	SupAndSup						
		Characteristic					

		Comb 19	Comb 20	Comb 21	Comb 22	Comb 23	Comb 24
Girder-SW	SupAddLc						
Precast-PT	SupAddLc						
Girder-CS	SupAddLc						
Precast-CS	SupAddLc						
Onsite-SW-01	SupAddLc						
SUM-SW	SupAddLc	1.00	1.00	1.00	1.00	1.00	1.00
SUM-PT	SupAddLc	0.90 / 1.10	0.90 / 1.10	0.90 / 1.10	0.90 / 1.10	0.90 / 1.10	0.90 / 1.10
SUM-SDL	SupAddLc	1.00	1.00	1.00	1.00	1.00	1.00
SUM-CSt0	SupAddLc	1.00	1.00	1.00	1.00	1.00	1.00
SUM-CStinf	SupAddLc		1.00				1.00
SUM-CStinf	SupAndLc						
LM1-TS.sup	SupAndSup						
LM1-UDL.sup	SupAndSup					0.20	0.20
LM3-1.sup	SupAndSup						
Pedestrian.su	SupAndSup						
Brake.sup	SupAndSup						
WindS-T.sup	SupAndSup			0.20	0.20		
WindS+T.sup	SupAndSup						
Temp.sup	SupAndSup	0.60	0.60			0.50	0.50
EQ.sup	SupAndSup						

		Comb 25	Comb 26	Comb 27	Comb 28	Comb 29	Comb 30
Girder-SW	SupAddLc						
Precast-PT	SupAddLc						
Girder-CS	SupAddLc						
Precast-CS	SupAddLc						
Onsite-SW-01	SupAddLc						
SUM-SW	SupAddLc	1.00 / 1.35	1.00 / 1.35	1.00 / 1.35	1.00 / 1.35	1.00 / 1.35	1.00 / 1.35
SUM-PT	SupAddLc	1.00	1.00	1.00	1.00	1.00	1.00
SUM-SDL	SupAddLc	1.00 / 1.35	1.00 / 1.35	1.00 / 1.35	1.00 / 1.35	1.00 / 1.35	1.00 / 1.35
SUM-CSt0	SupAddLc	1.00	1.00	1.00	1.00	1.00	1.00
SUM-CStinf	SupAddLc						
SUM-CStinf	SupAndLc	1.00	1.00	1.00	1.00	1.00	1.00
LM1-TS.sup	SupAndSup	1.35	1.01	1.01			1.01
LM1-UDL.sup	SupAndSup	1.35	0.54	0.54			0.54
LM3-1.sup	SupAndSup						
Pedestrian.su	SupAndSup	1.35	0.54	0.54			0.54
Brake.sup	SupAndSup						1.35
WindS-T.sup	SupAndSup				1.50		
WindS+T.sup	SupAndSup	0.90		1.50			
Temp.sup	SupAndSup		1.50				
EQ.sup	SupAndSup						

		Comb 31	Comb 32	Comb 33	Comb 34	Comb 35	Comb 36
Girder-SW	SupAddLc						1.00
Precast-PT	SupAddLc						1.00
Girder-CS	SupAddLc						
Precast-CS	SupAddLc						1.00
Onsite-SW-01	SupAddLc						
SUM-SW	SupAddLc	1.00 / 1.35	1.00	1.00	1.00	1.00	
SUM-PT	SupAddLc	1.00	1.00	1.00	0.90 / 1.10	0.90 / 1.10	
SUM-SDL	SupAddLc	1.00 / 1.35	1.00	1.00	1.00	1.00	

		Combinations					
LF/SUP	Rule	(+) / (-)	(+) / (-)	(+) / (-)	(+) / (-)	(+) / (-)	(+) / (-)
SUM-CSt0	SupAddLc	1.00	1.00	1.00	1.00	1.00	
SUM-CStinf	SupAddLc					1.00	
SUM-CStinf	SupAndLc	1.00	1.00	1.00			
LM1-TS.sup	SupAndSup						
LM1-UDL.sup	SupAndSup			0.20			
LM3-1.sup	SupAndSup				1.00	1.00	
Pedestrian.su	SupAndSup						
Brake.sup	SupAndSup						
WindS-T.sup	SupAndSup						
WindS+T.sup	SupAndSup						
Temp.sup	SupAndSup		0.50	0.50	0.50	0.50	
EQ.sup	SupAndSup			1.00			

		Comb 37	Comb 38				
Girder-SW	SupAddLc						
Precast-PT	SupAddLc						
Girder-CS	SupAddLc						
Precast-CS	SupAddLc						
Onsite-SW-01	SupAddLc						
SUM-SW	SupAddLc	1.00	1.00				
SUM-PT	SupAddLc	0.90 / 1.10	0.90 / 1.10				
SUM-SDL	SupAddLc	1.00	1.00				
SUM-CSt0	SupAddLc	1.00	1.00				
SUM-CStinf	SupAddLc		1.00				
SUM-CStinf	SupAndLc						
LM1-TS.sup	SupAndSup						
LM1-UDL.sup	SupAndSup						
LM3-1.sup	SupAndSup	1.00	1.00				
Pedestrian.su	SupAndSup						
Brake.sup	SupAndSup						
WindS-T.sup	SupAndSup						
WindS+T.sup	SupAndSup						
Temp.sup	SupAndSup						
EQ.sup	SupAndSup						

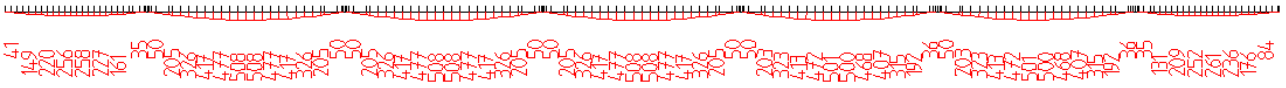
4.4. АНАЛИЗА СУПЕРСТРУКТУРЕ – ПОДУЖНИ ПРАВАЦ

STRUCTURAL ANALYSIS – LONGITUDINAL DIRECTION

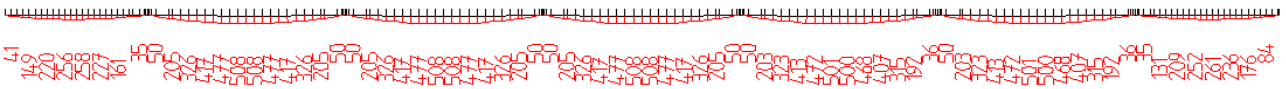
4.4.1 ДИЈАГРАМ УТИЦАЈА ЗА ПОЈЕДИНАЧНА ОПТЕРЕЋЕЊА
DIAGRAMS BY LOAD CASE

Girder-Girder-SW

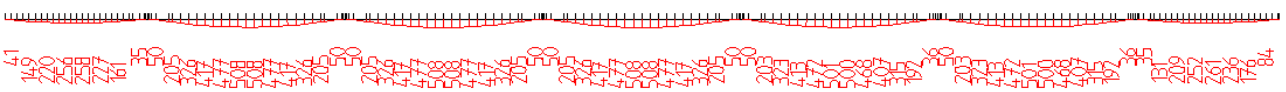
Mz(kNm) - GIRDER 1



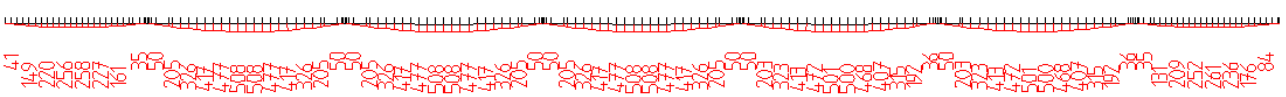
Mz(kNm) - GIRDER 2



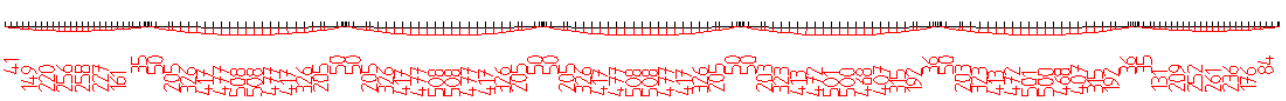
Mz(kNm) - GIRDER 3



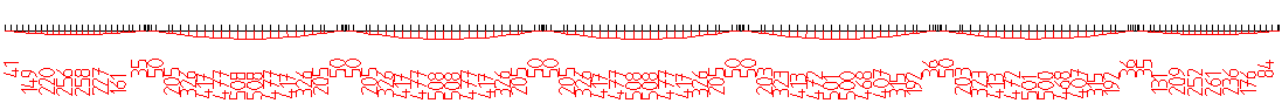
Mz(kNm) - GIRDER 4



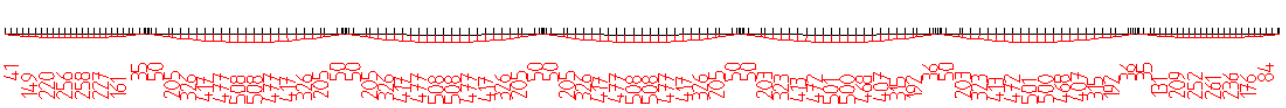
Mz(kNm) - GIRDER 5



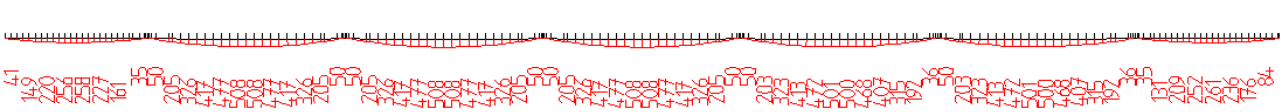
Mz(kNm) - GIRDER 6



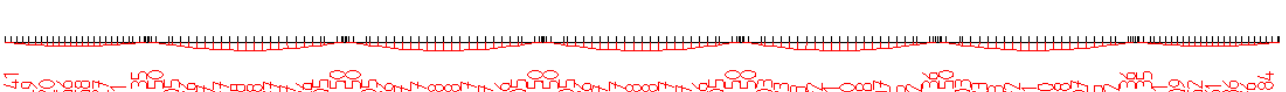
Mz(kNm) - GIRDER 7



Mz(kNm) - GIRDER 8



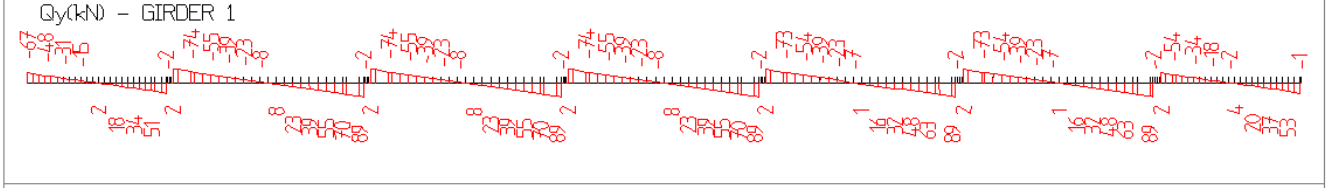
Mz(kNm) - GIRDER 9



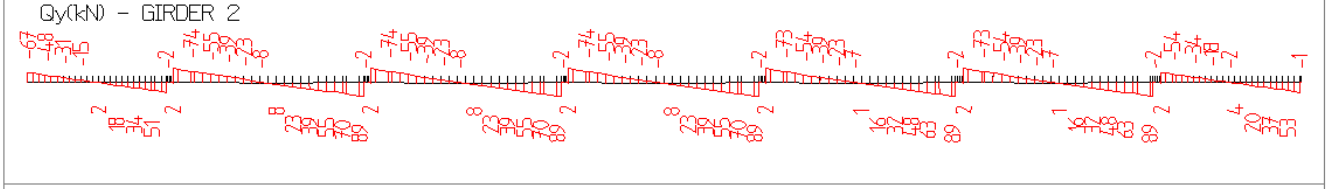
Mz(kNm) - GIRDER 10

Girder-Girder-SW

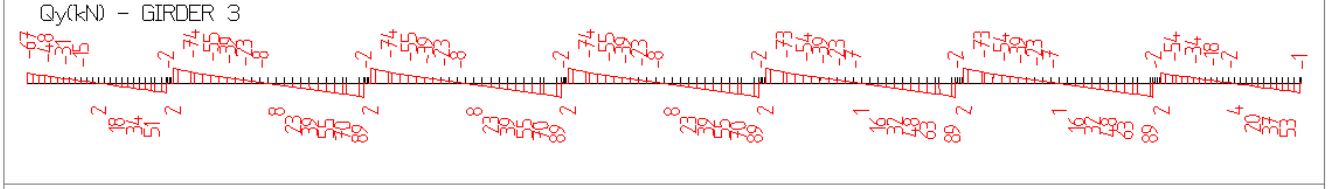
Qy(kN) - GIRDER 1



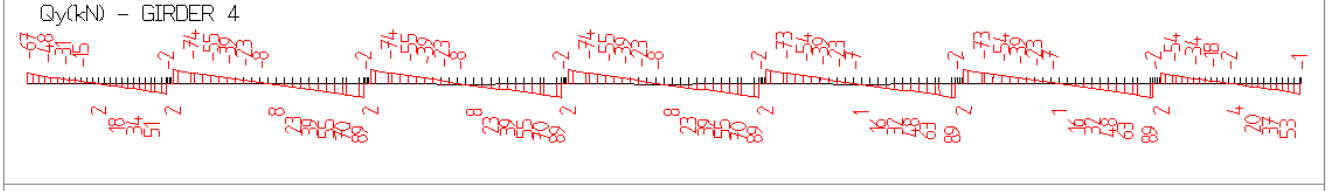
Qy(kN) - GIRDER 2



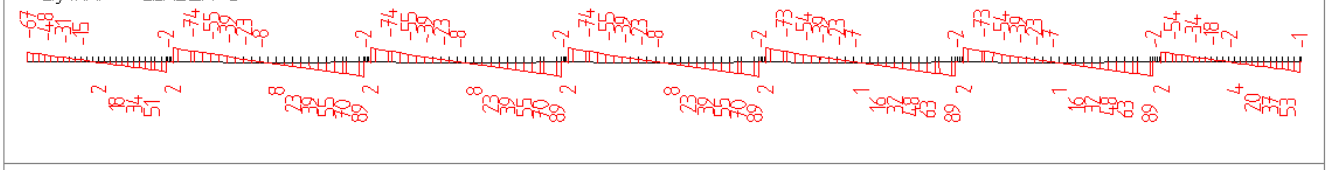
Qy(kN) - GIRDER 3



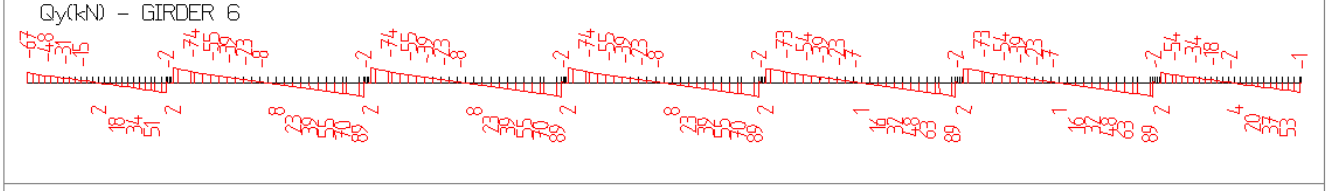
Qy(kN) - GIRDER 4



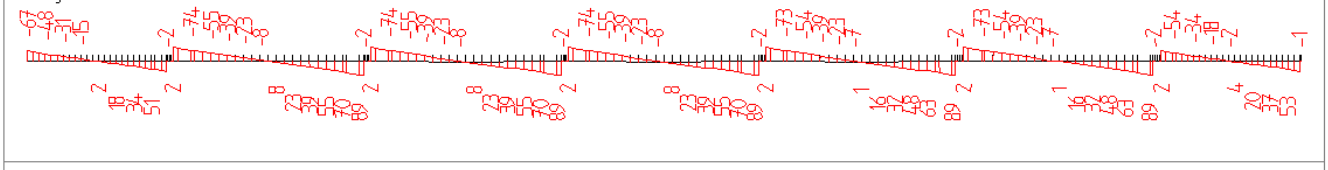
Qy(kN) - GIRDER 5



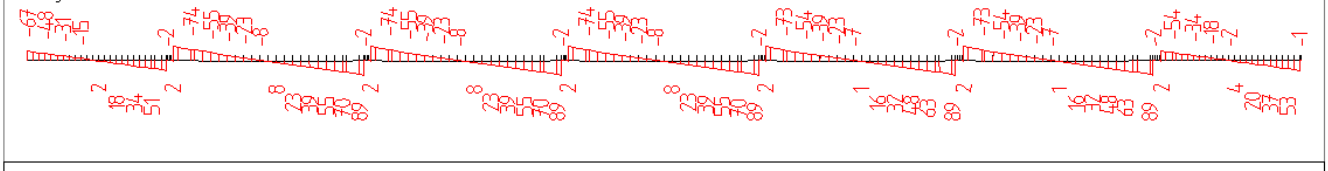
Qy(kN) - GIRDER 6



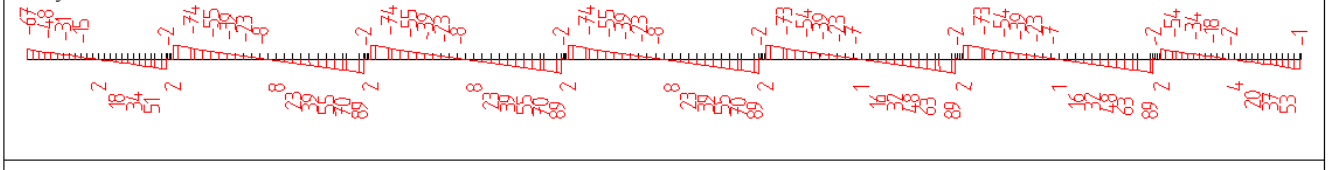
Qy(kN) - GIRDER 7



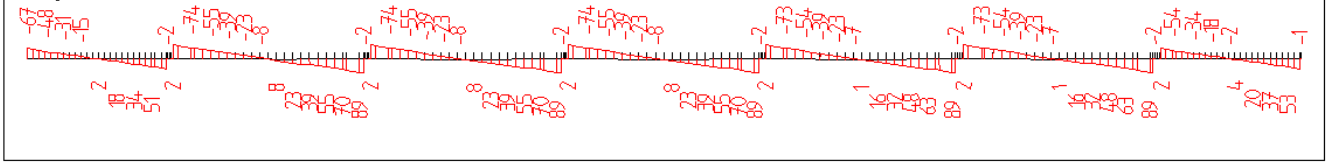
Qy(kN) - GIRDER 8



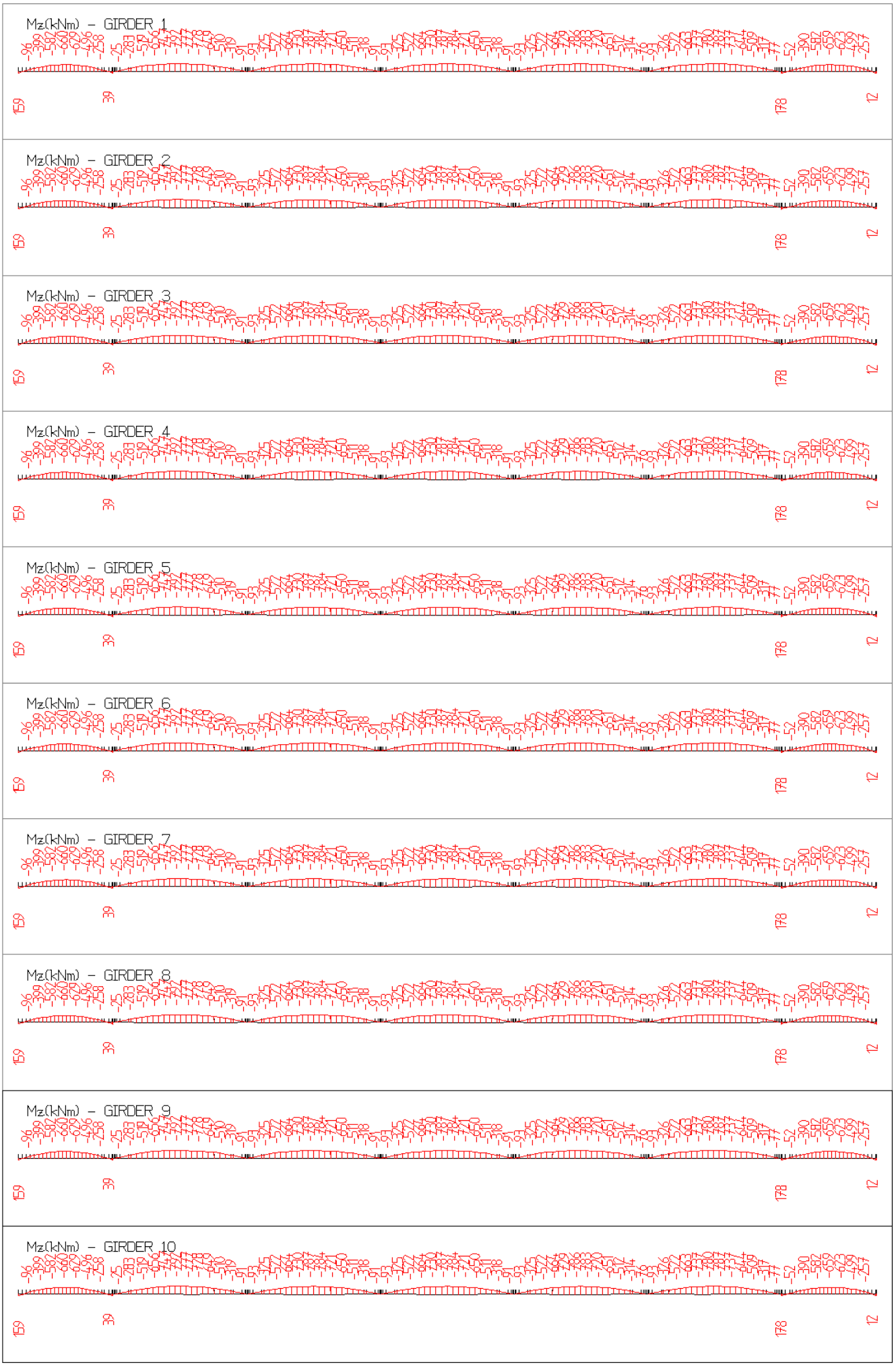
Qy(kN) - GIRDER 9



Qy(kN) - GIRDER 10



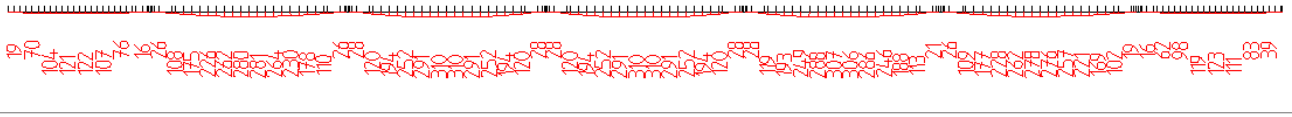
Girder-SUM-PT



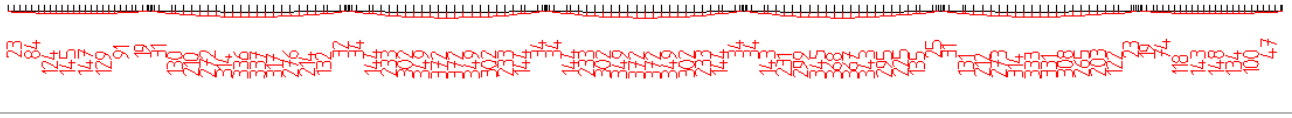
Girder-SUM-PT

Girder-Onsite-SW-01

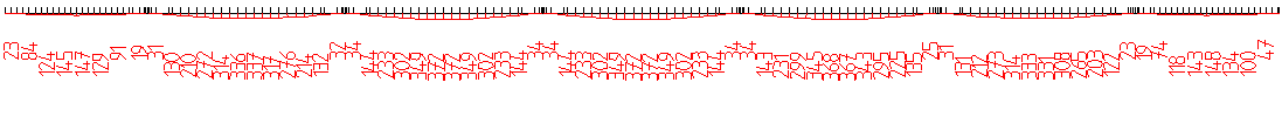
Mz(kNm) - GIRDER 1



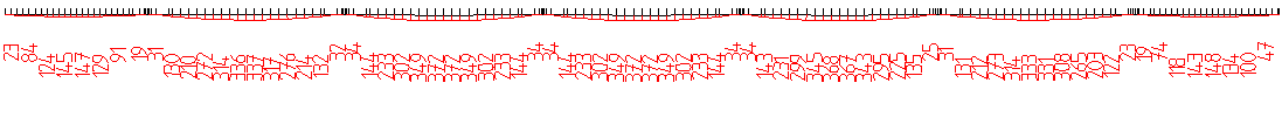
Mz(kNm) - GIRDER 2



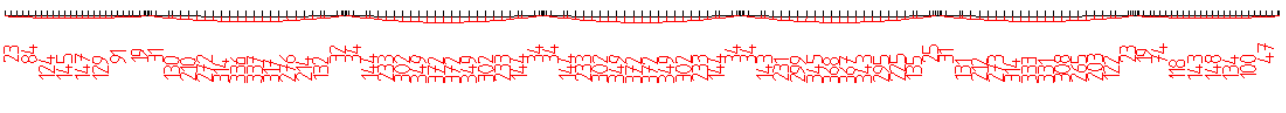
Mz(kNm) - GIRDER 3



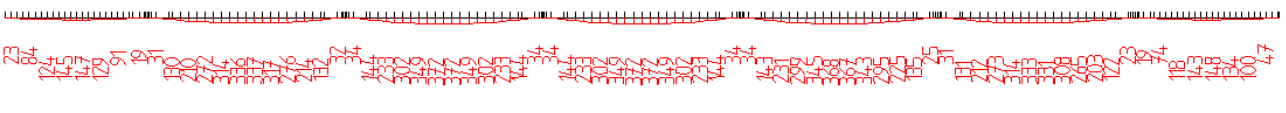
Mz(kNm) - GIRDER 4



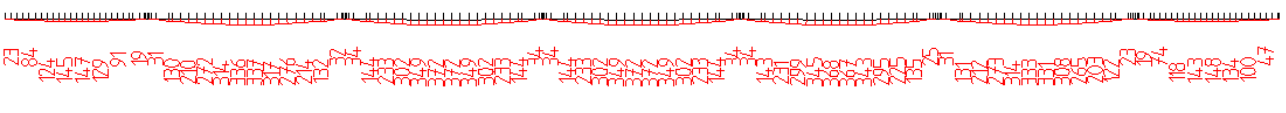
Mz(kNm) - GIRDER 5



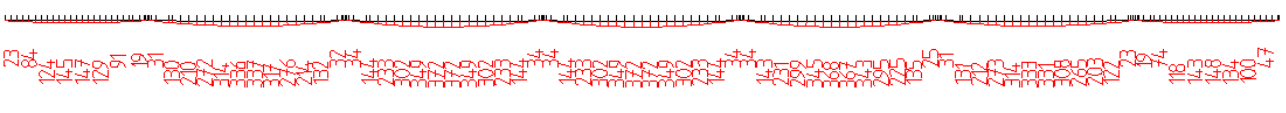
Mz(kNm) - GIRDER 6



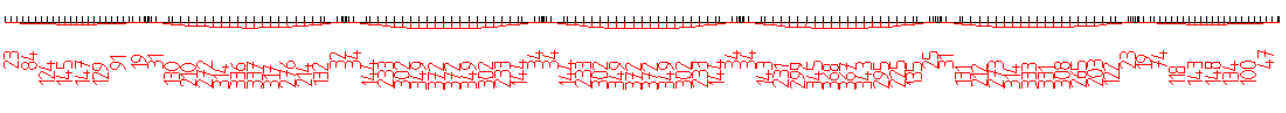
Mz(kNm) - GIRDER 7



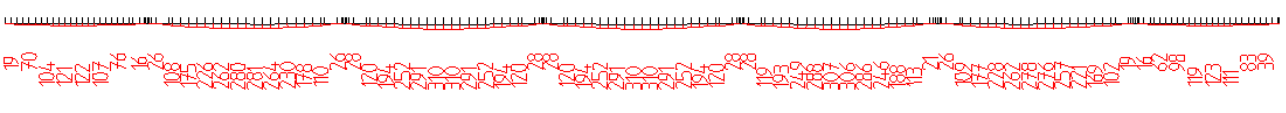
Mz(kNm) - GIRDER 8



Mz(kNm) - GIRDER 9



Mz(kNm) - GIRDER 10



Girder-Onsite-SW-01

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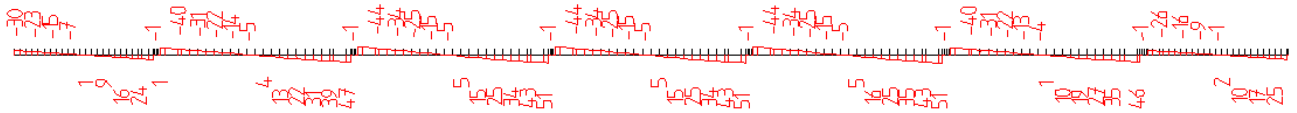
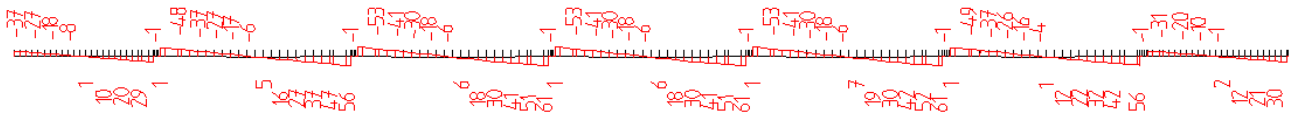


Qy(kN) - GIRDER 2



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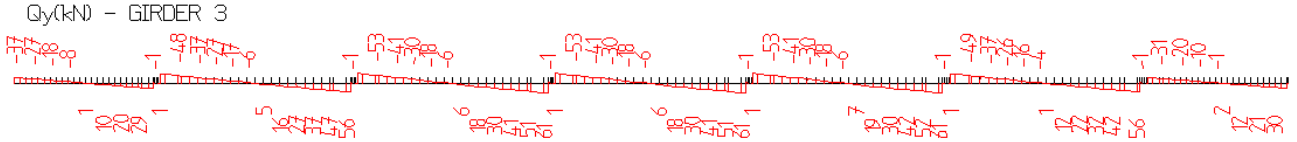

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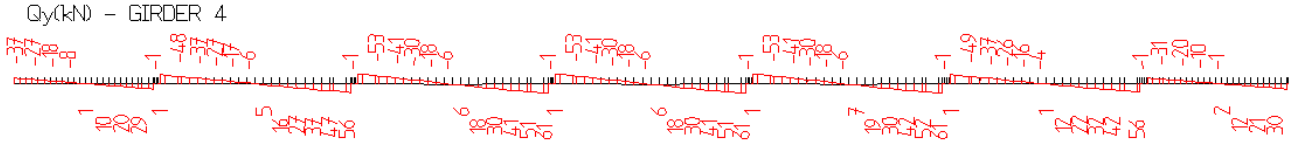

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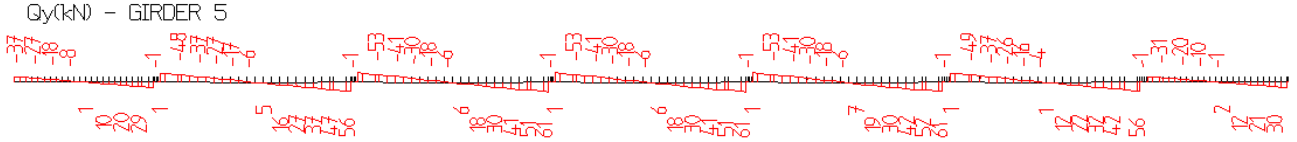

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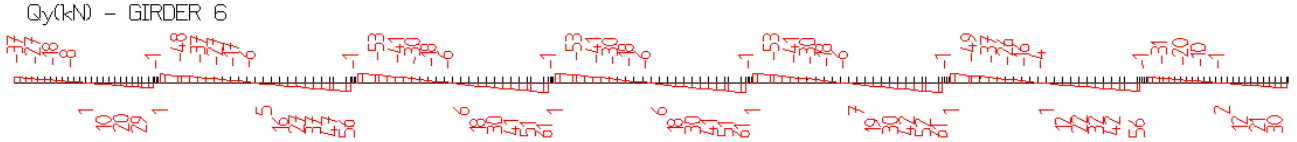
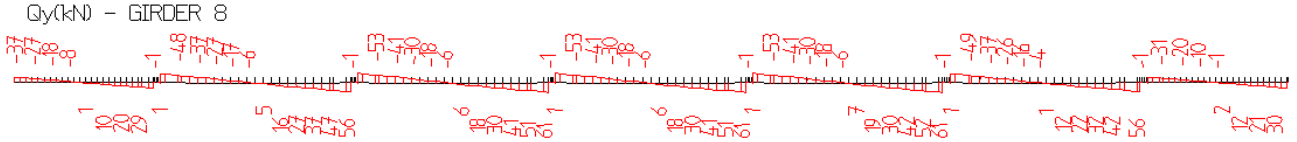
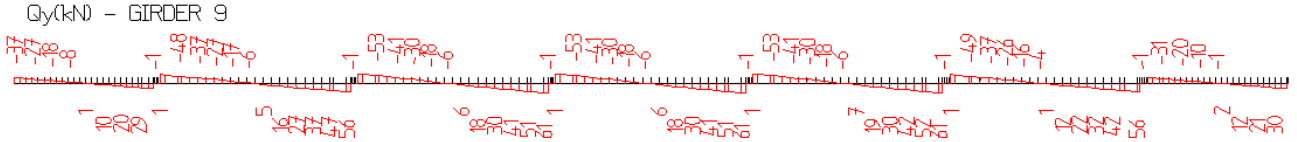


Qy(kN) - GIRDER 7

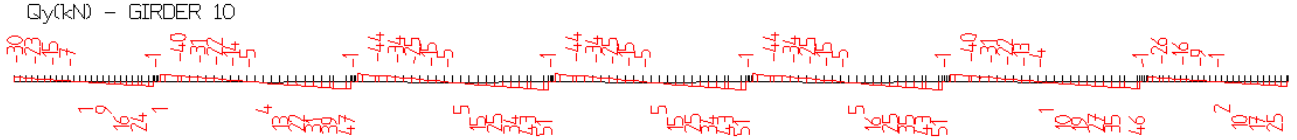
Qy(kN) - GIRDER 8



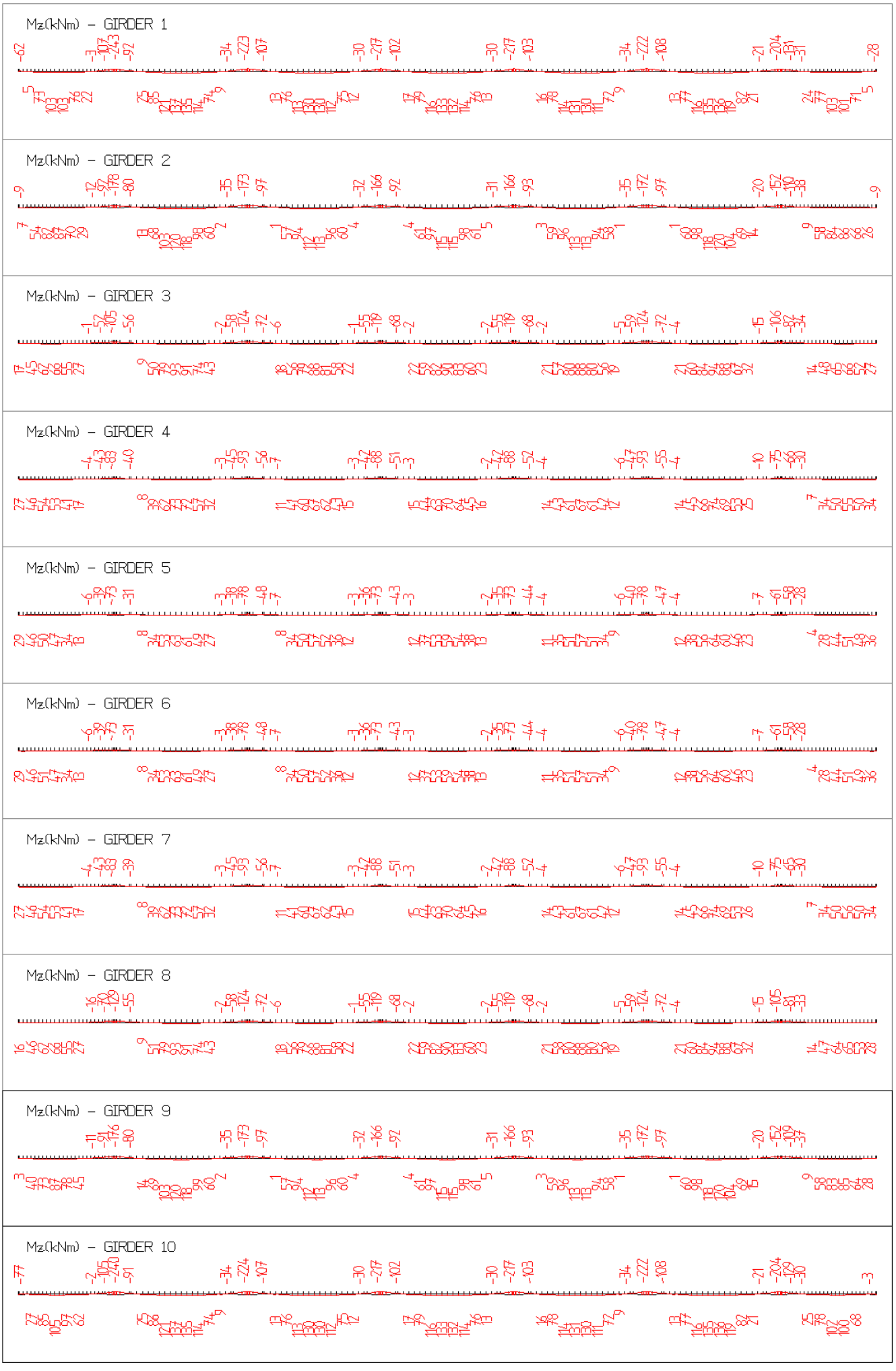
Qy(kN) - GIRDER 9



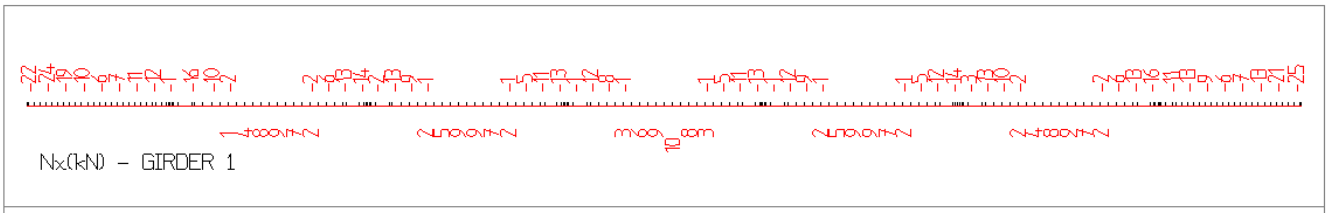
Qy(kN) - GIRDER 10

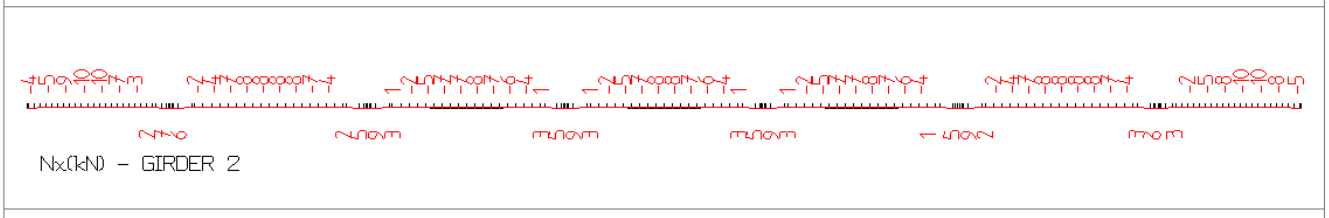


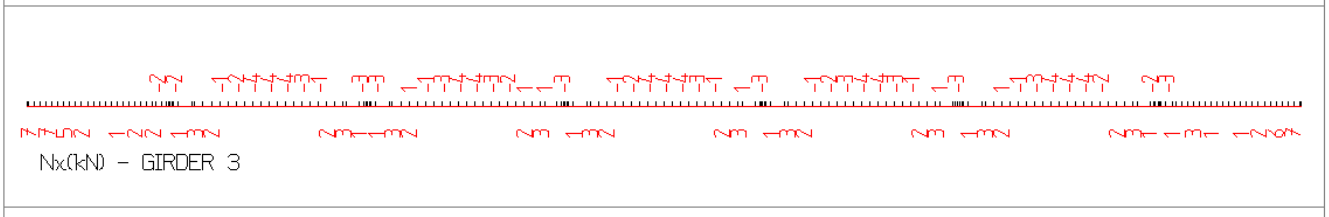
Girder-Final-SDL

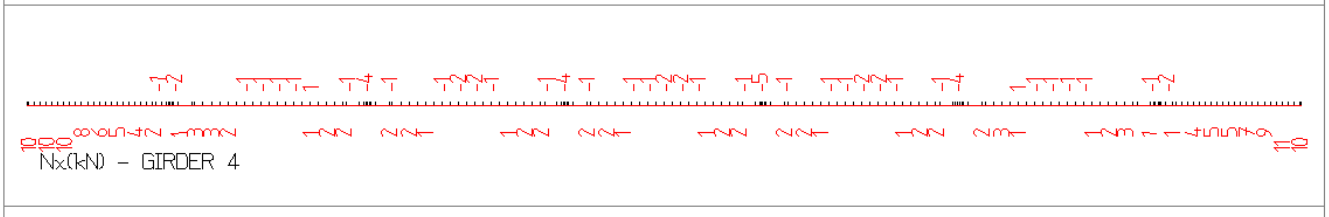


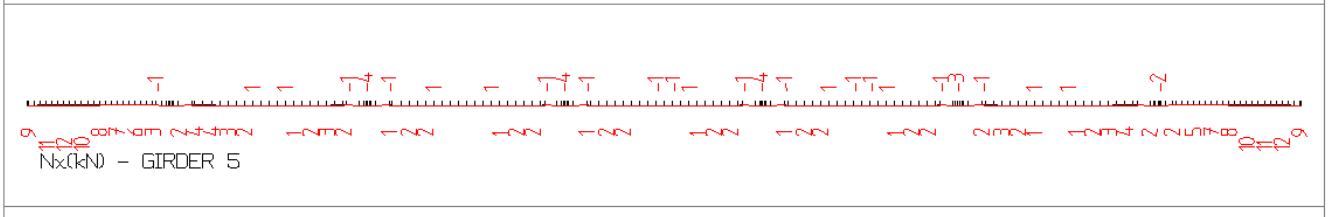
Girder-Final-SDL

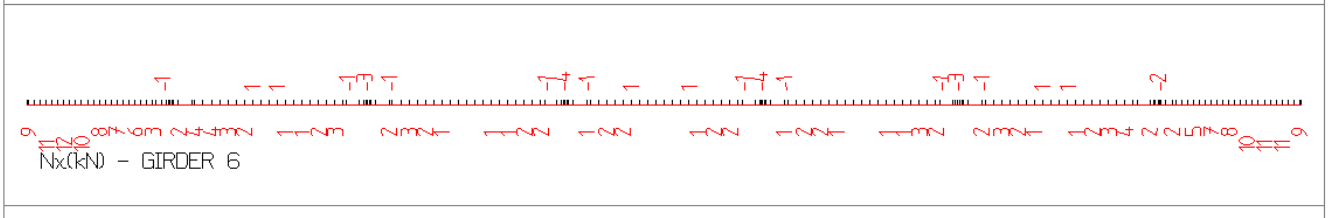


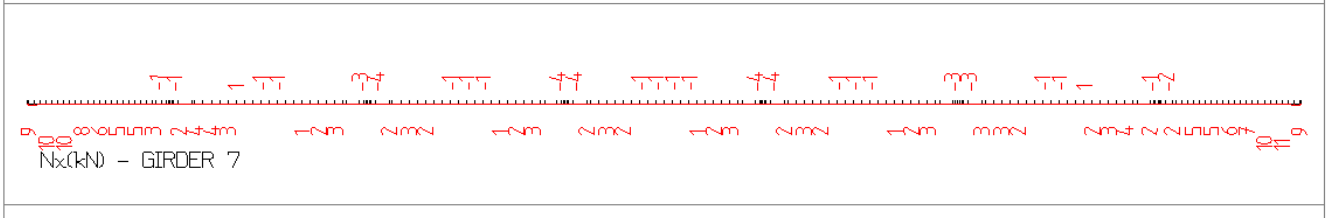


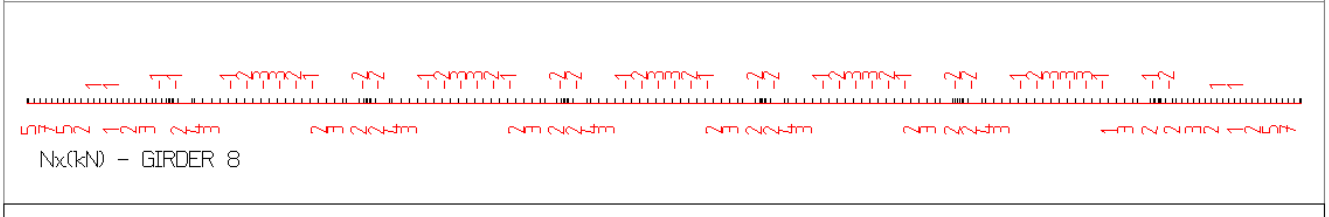


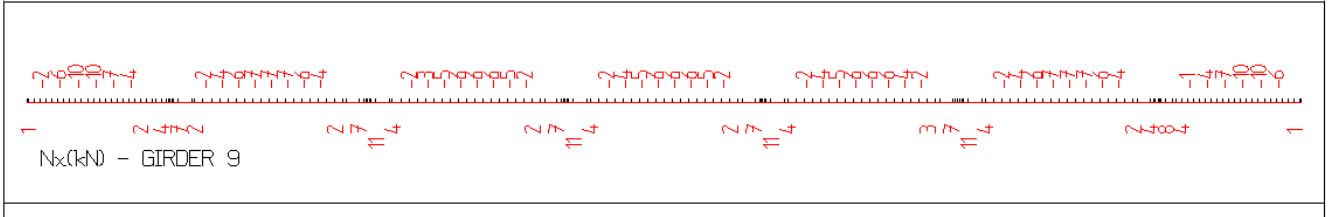


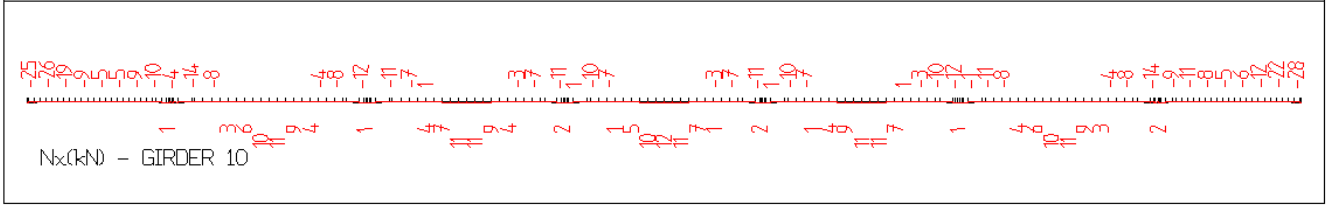




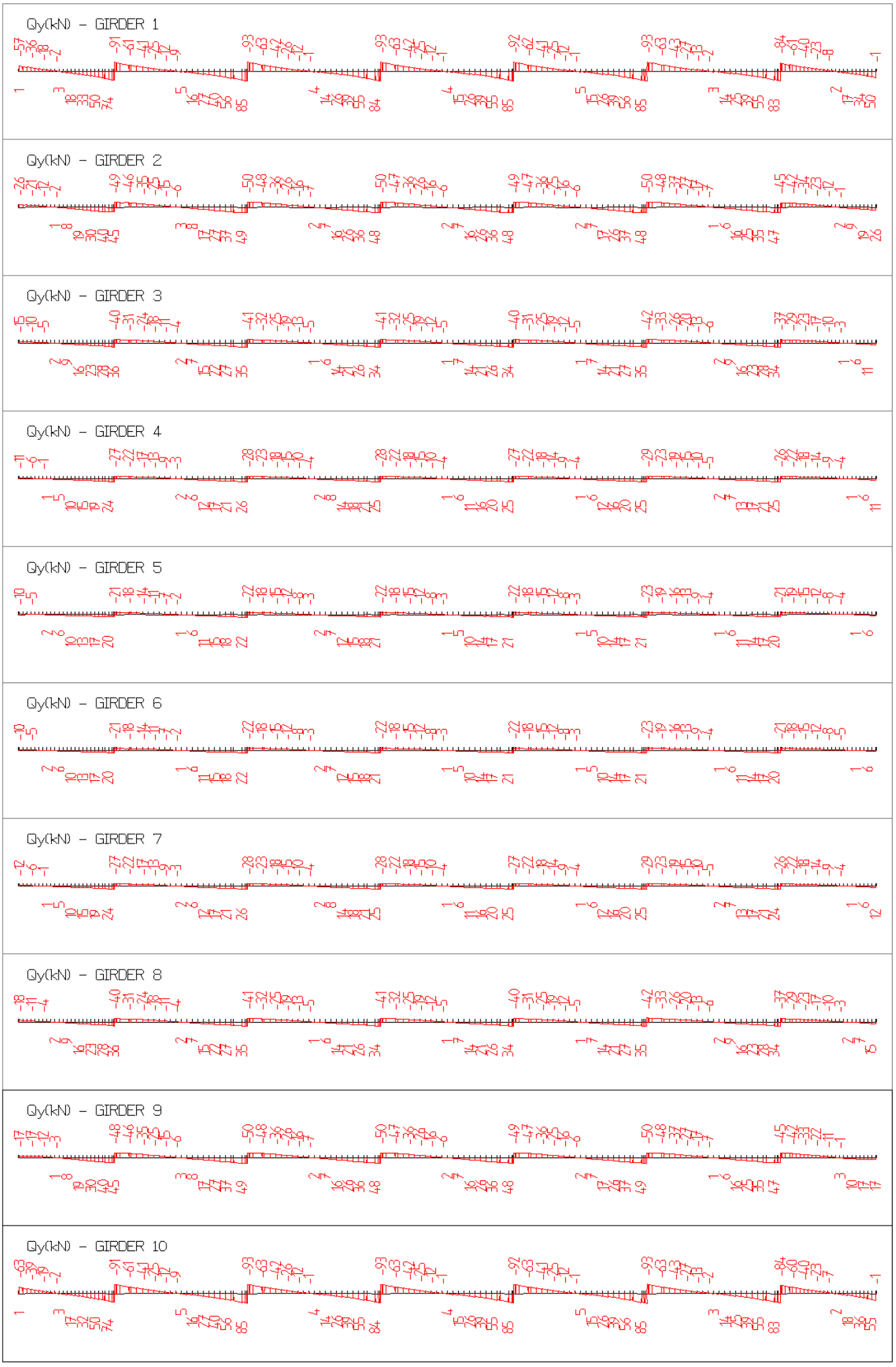








Girder-Final-SDL



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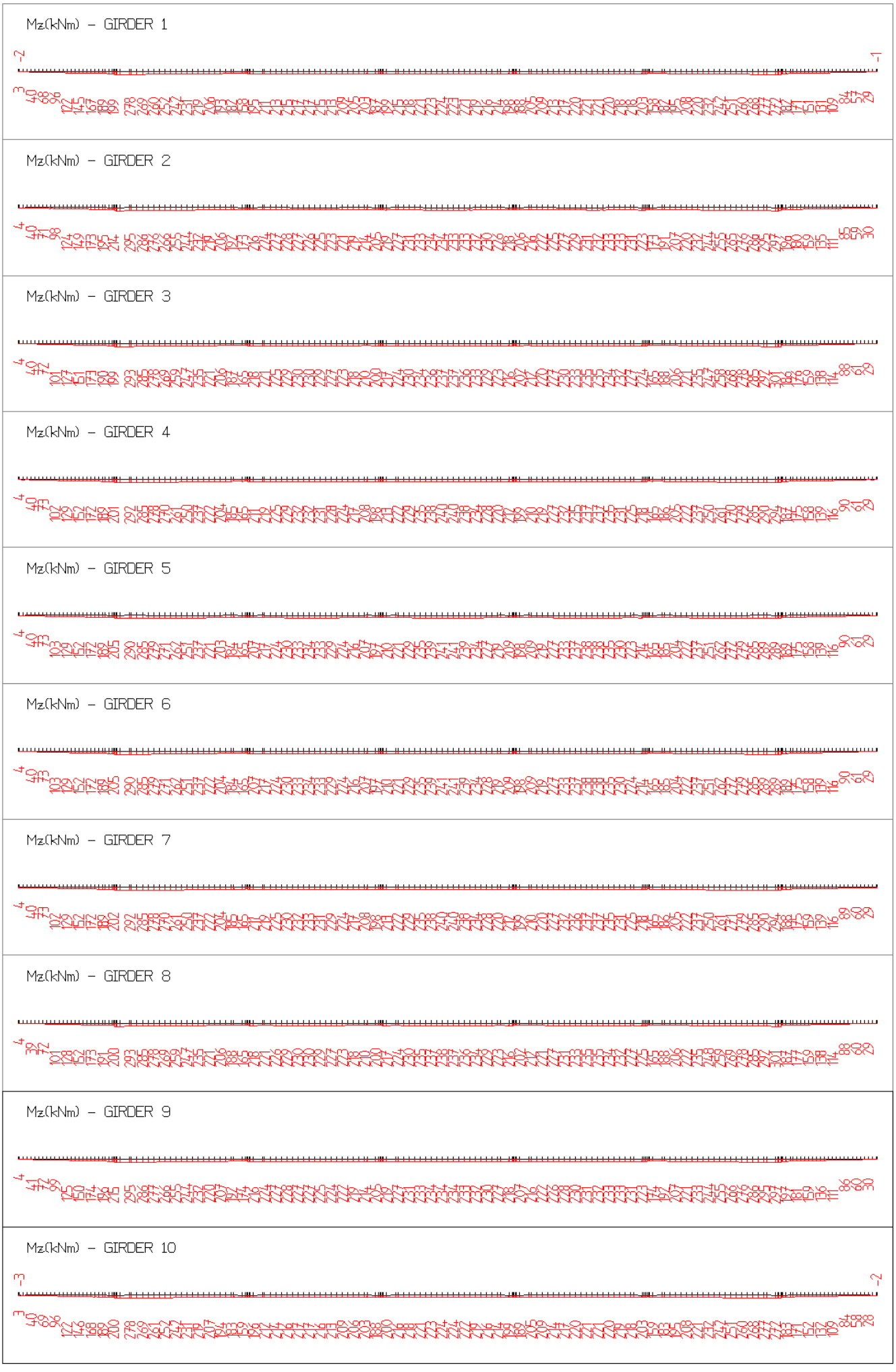
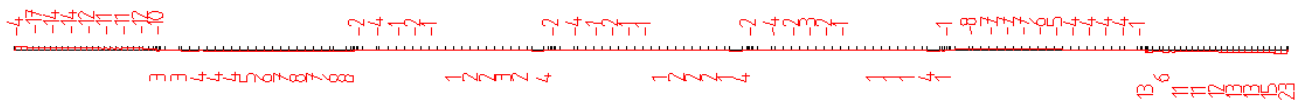


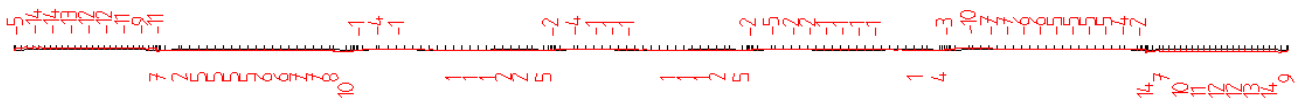
Girder-Final-CS

Girder-Final-CS

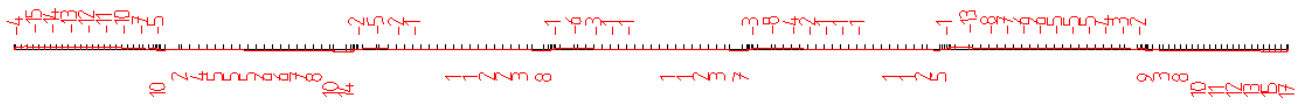
Qy(kN) - GIRDER 1



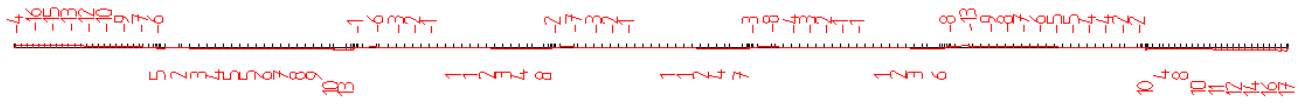
Qy(kN) - GIRDER 2



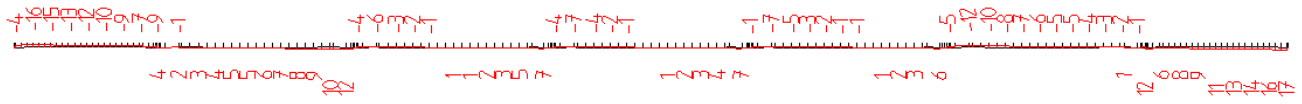
Qy(kN) - GIRDER 3



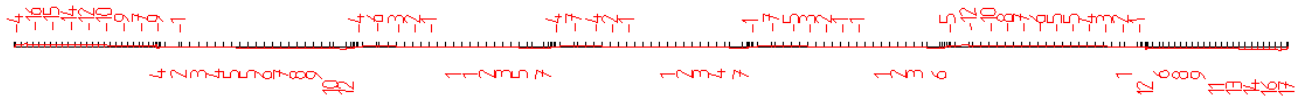
Qy(kN) - GIRDER 4



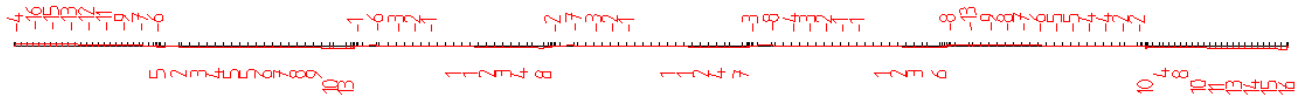
Qy(kN) - GIRDER 5



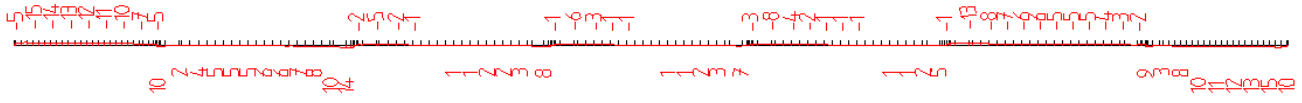
Qy(kN) - GIRDER 6



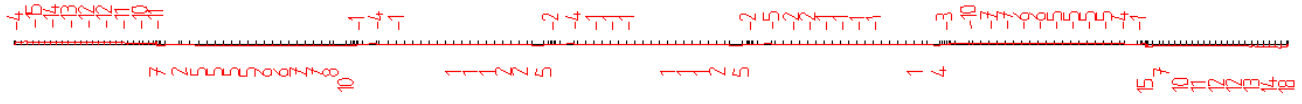
Qy(kN) - GIRDER 7



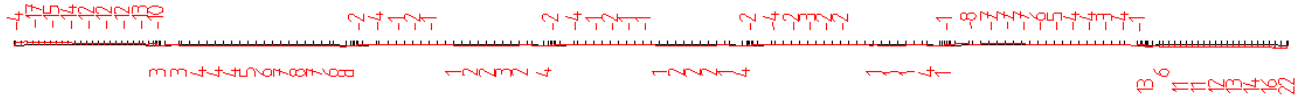
Qy(kN) - GIRDER 8



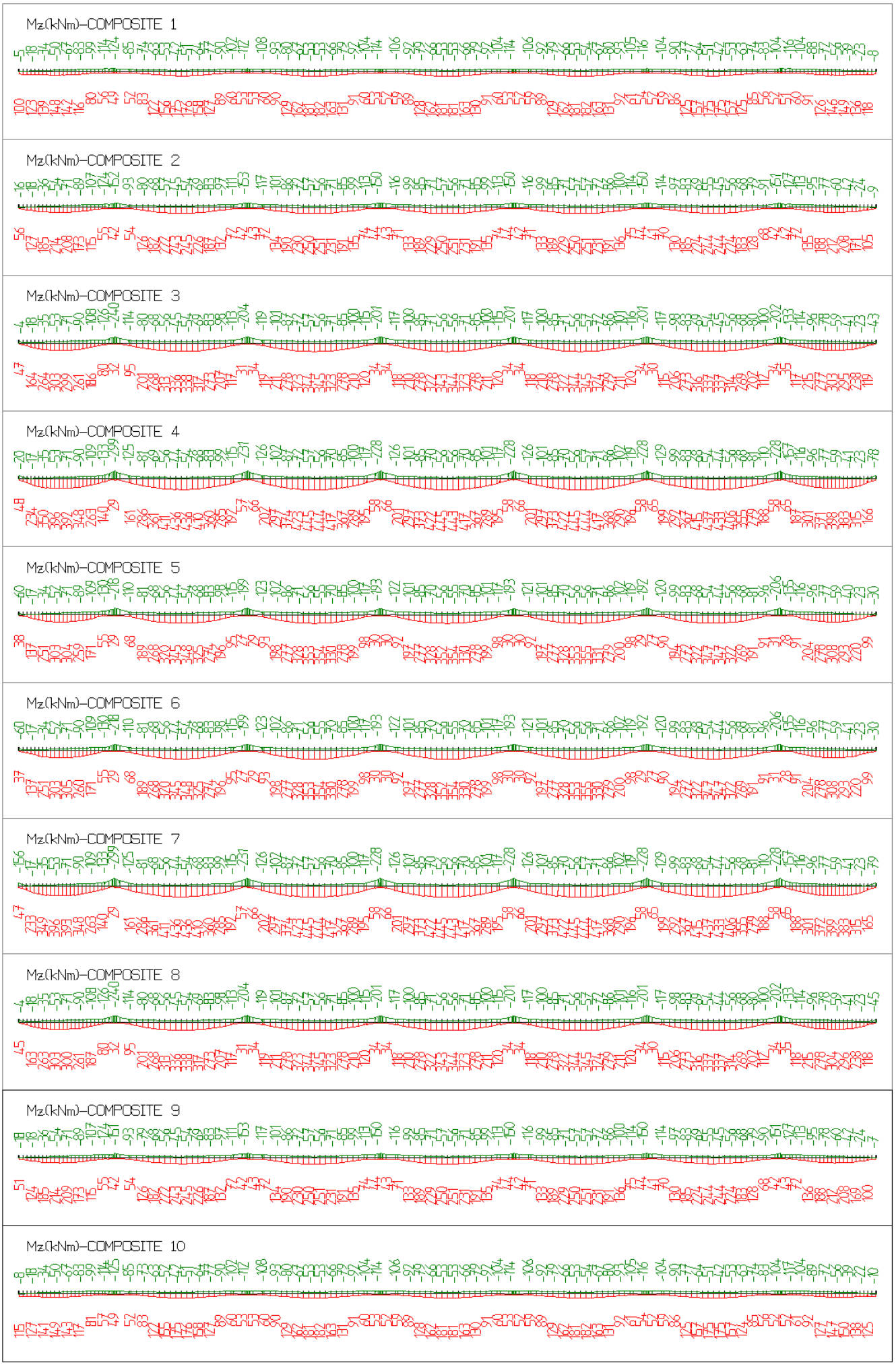
Qy(kN) - GIRDER 9



Qy(kN) - GIRDER 10

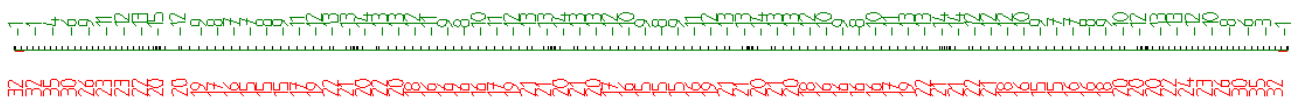


Composite-LM1-TS.sup

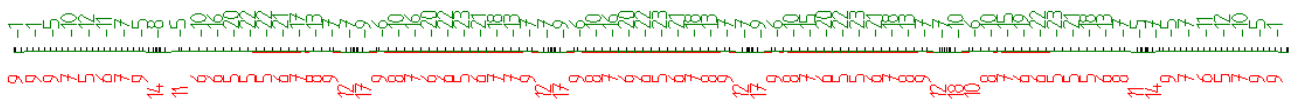


Composite-LM1-TS.sup

Nx(kN)-COMPOSITE 1

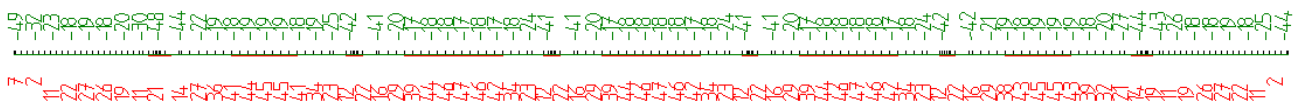


Nx(kN)-COMPOSITE 2

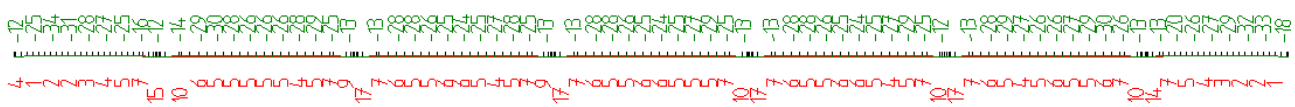


Nx(kN))-COMPOSITE 3

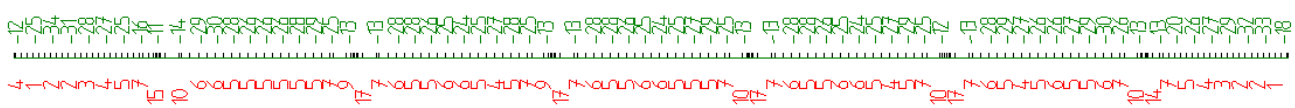
Nx(kN)-COMPOSITE 4



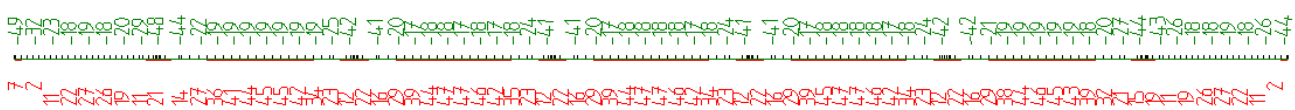
Nx(kN)-COMPOSITE 5



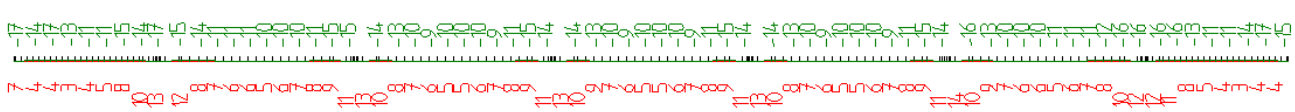
Nx(kN)-COMPOSITE 6



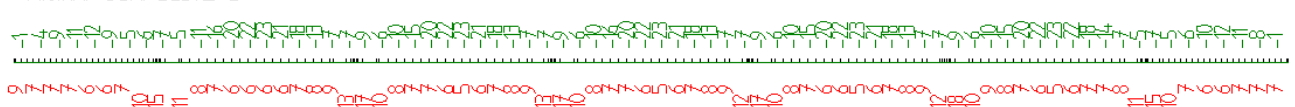
Nx(kN)-COMPOSITE 7



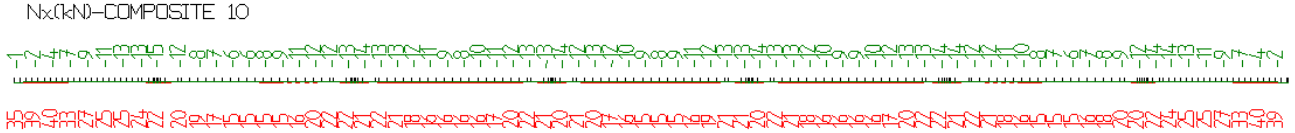
Nx(kN)-COMPOSITE 8



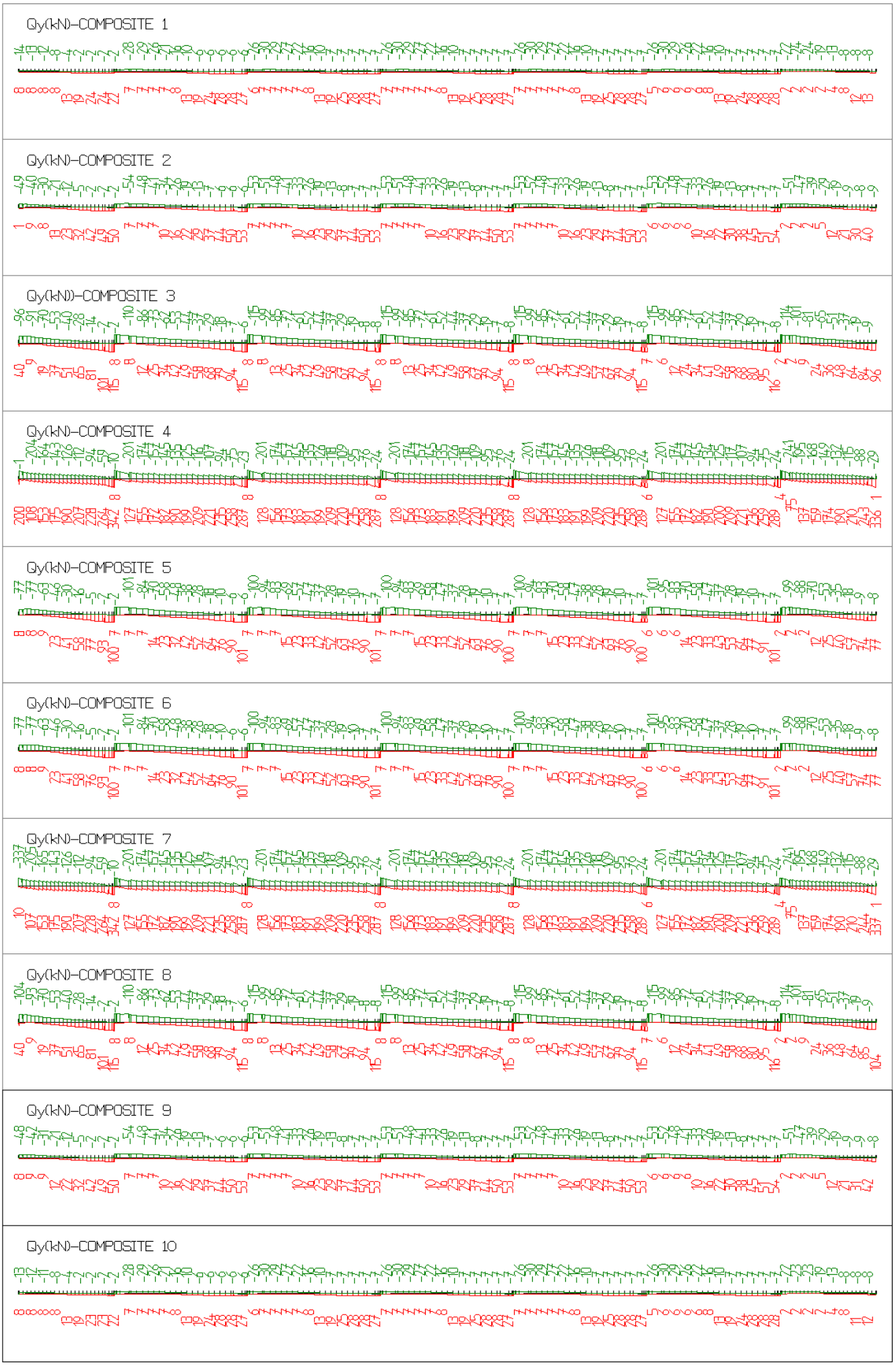
Nx(kN)-COMPOSITE 9



Nx(kN)-COMPOSITE 10



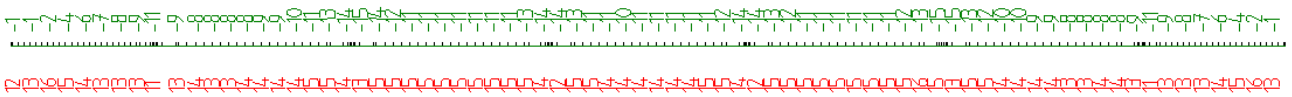
Composite-LM1-TS.sup



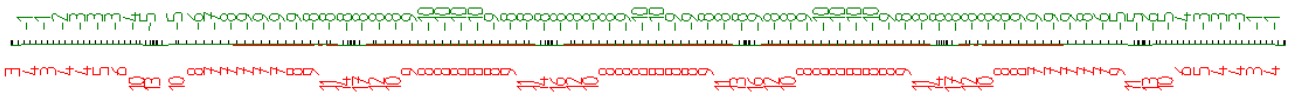
Composite-LM1-UDL.sup

Composite-LM1-UDL.sup

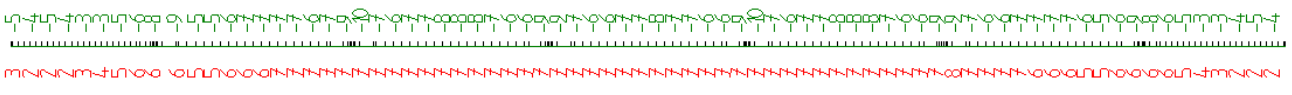
Nx(kN)-COMPOSITE 1



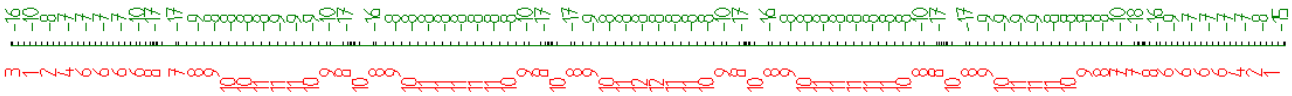
Nx(kN)-COMPOSITE 2



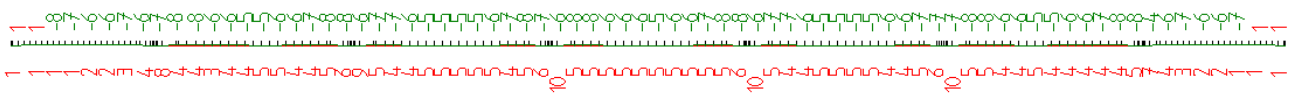
Nx(kN))-COMPOSITE 3



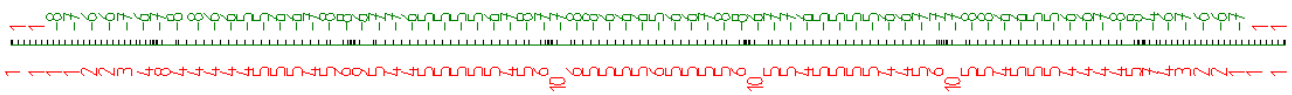
Nx(kN)-COMPOSITE 4



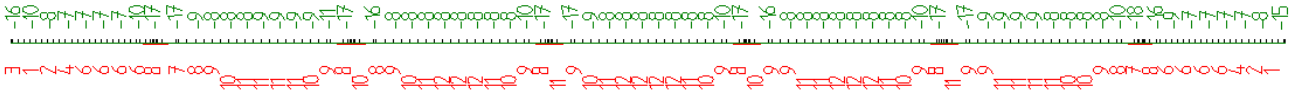
Nx(kN)-COMPOSITE 5



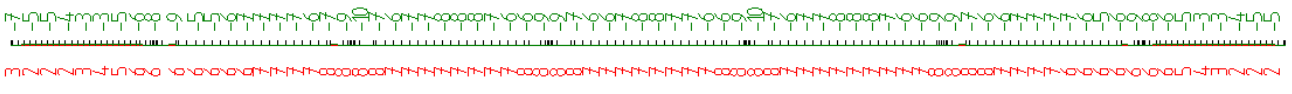
Nx(kN)-COMPOSITE 6



Nx(kN)-COMPOSITE 7



Nx(kN)-COMPOSITE 8



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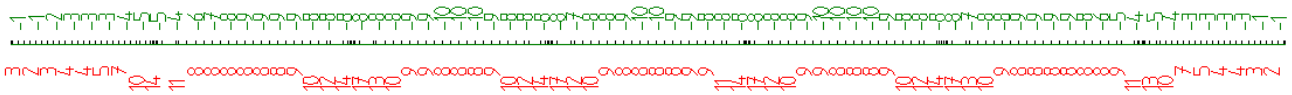
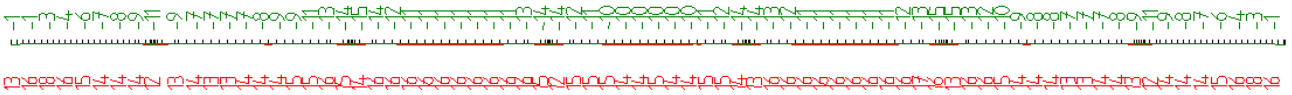


Nx(kN)-COMPOSITE 10



Composite-LM1-UDL.sup

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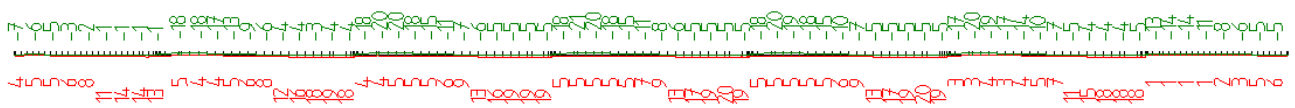
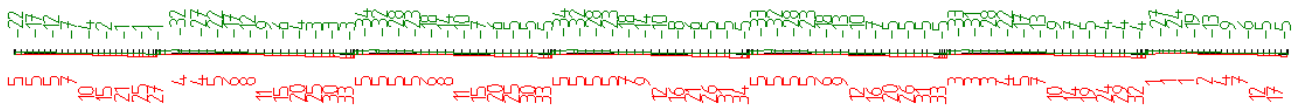
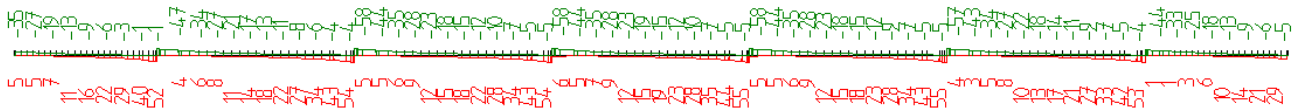


Qy(kN)-COMPOSITE 2



Qy(kN))-COMPOSITE 3



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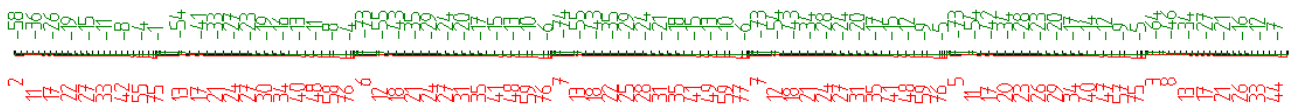

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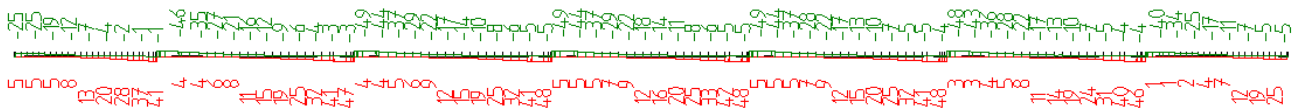

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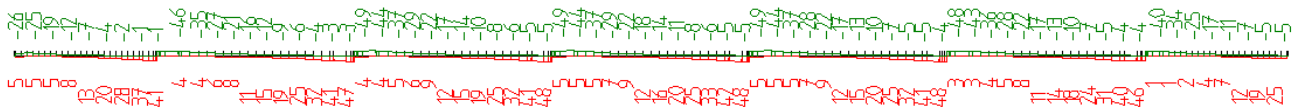
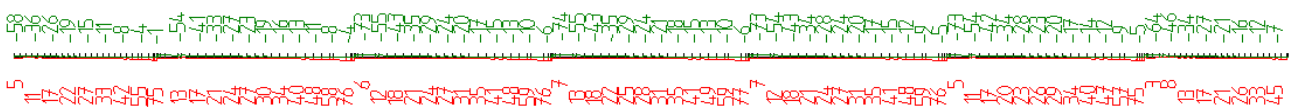


Qy(kN)-COMPOSITE 7



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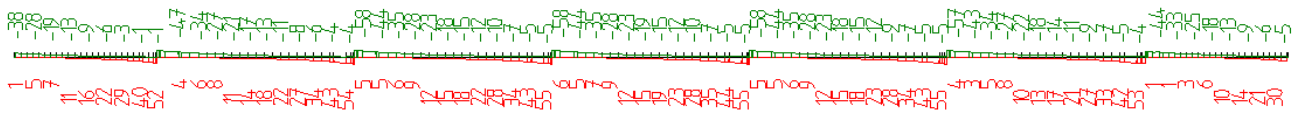

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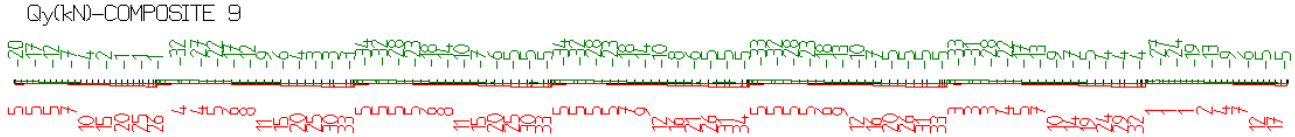

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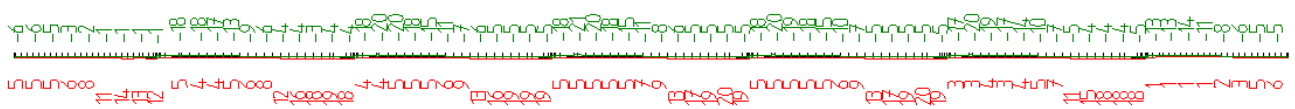

Mz(kNm)-COMPOSITE 1

Mz(kNm)-COMPOSITE 2

Mz(kNm)-COMPOSITE 3

Mz(kNm)-COMPOSITE 4

Mz(kNm)-COMPOSITE 5

Mz(kNm)-COMPOSITE 6

Mz(kNm)-COMPOSITE 7

Mz(kNm)-COMPOSITE 8

Mz(kNm)-COMPOSITE 9

Mz(kNm)-COMPOSITE 10

Nx(kN)-COMPOSITE 1

Nx(kN)-COMPOSITE 2

Nx(kN))-COMPOSITE 3

Nx(kN)-COMPOSITE 4

Nx(kN)-COMPOSITE 5

Nx(kN)-COMPOSITE 6

Nx(kN)-COMPOSITE 7

Nx(kN)-COMPOSITE 8

Nx(kN)-COMPOSITE 9

Nx(kN)-COMPOSITE 10

Qy(kN)-COMPOSITE 1

Qy(kN)-COMPOSITE 2

Qy(kN))-COMPOSITE 3

Qy(kN)-COMPOSITE 4

Qy(kN)-COMPOSITE 5

Qy(kN)-COMPOSITE 6

Qy(kN)-COMPOSITE 7

Qy(kN)-COMPOSITE 8

Qy(kN)-COMPOSITE 9

Qy(kN)-COMPOSITE 10

Composite-Brake.sup

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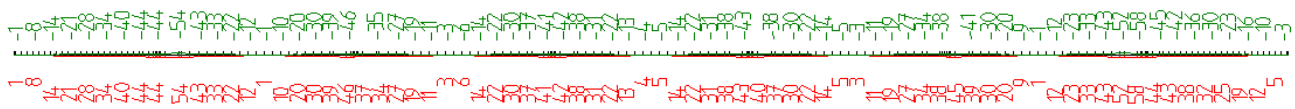

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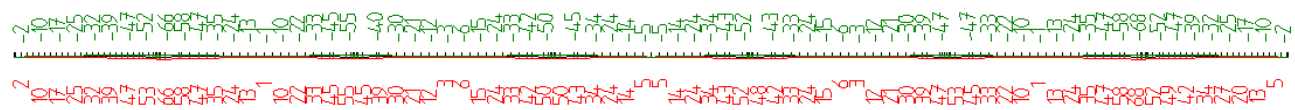

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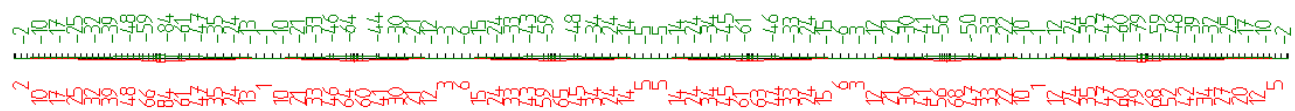

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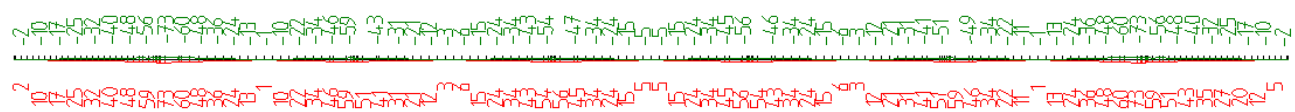

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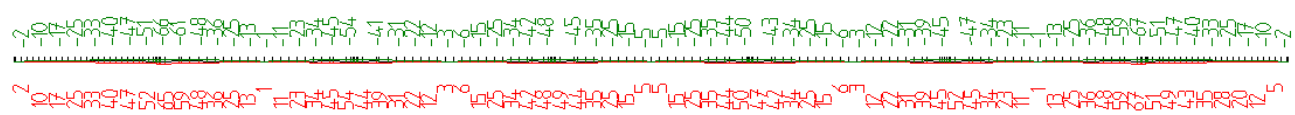

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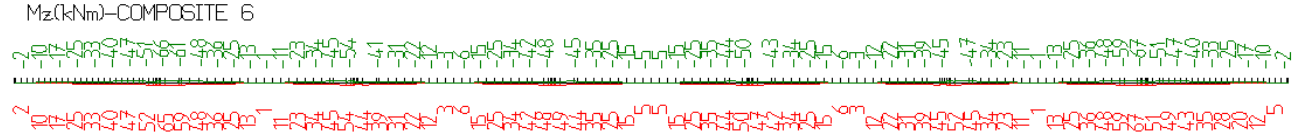
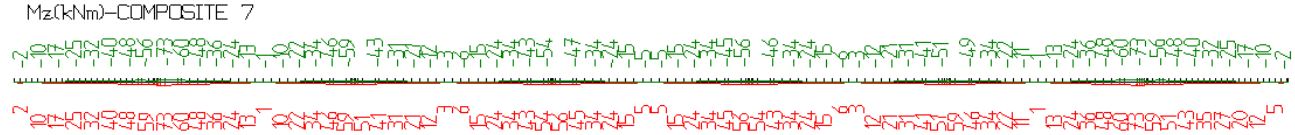


Mz(kNm)-COMPOSITE 7



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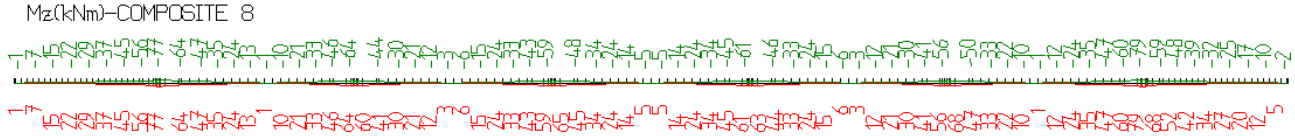
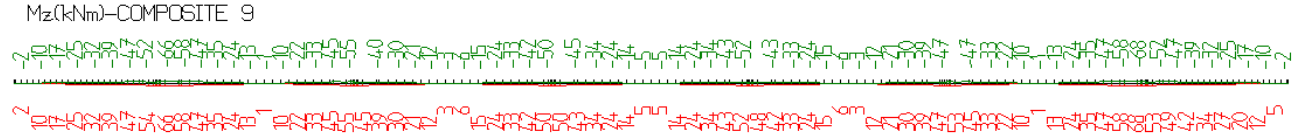
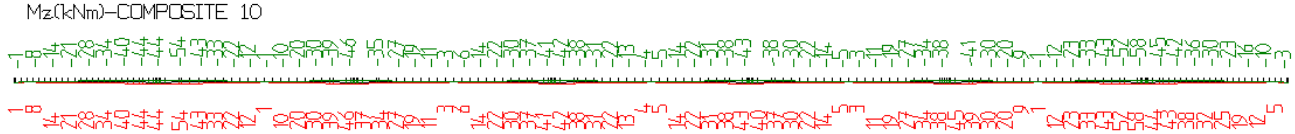


Mz(kNm)-COMPOSITE 9



Mz(kNm)-COMPOSITE 10



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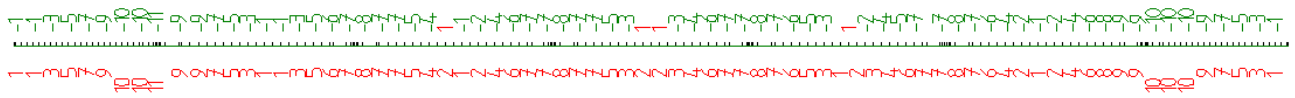
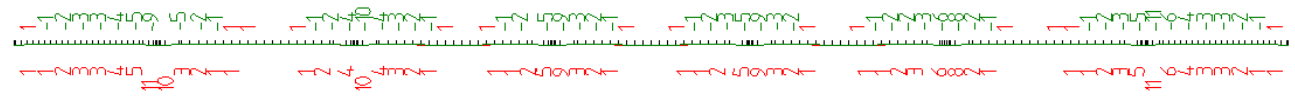
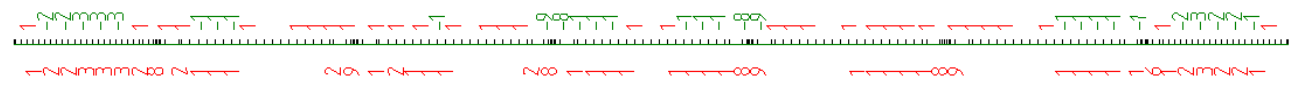


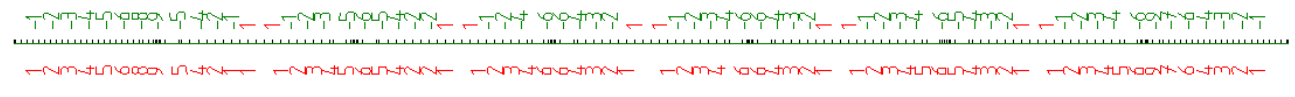
Nx(kN)-COMPOSITE 2



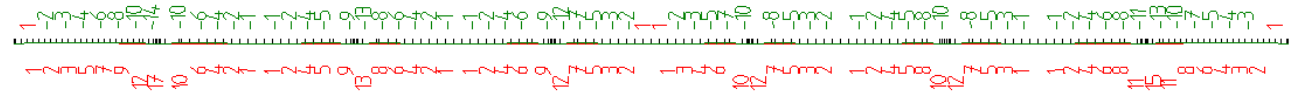
Nx(kN))-COMPOSITE 3



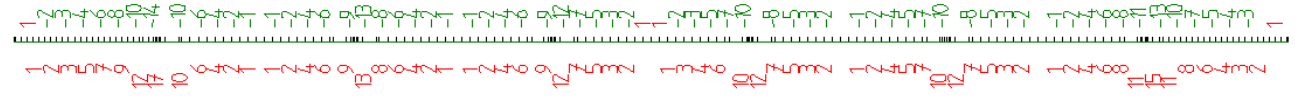
Nx(kN)-COMPOSITE 4



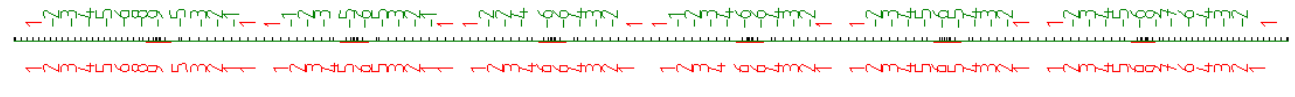
Nx(kN)-COMPOSITE 5



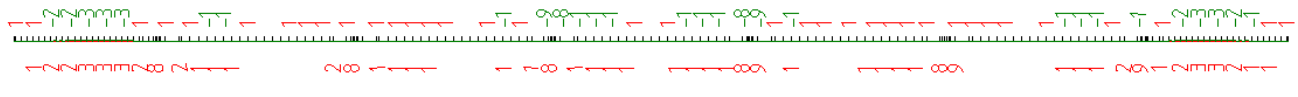
Nx(kN)-COMPOSITE 6



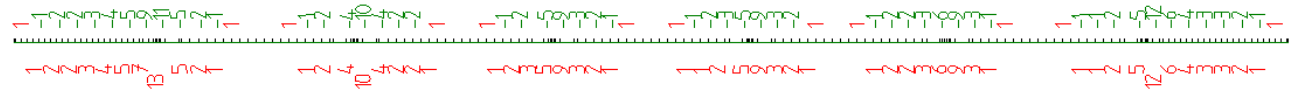
Nx(kN)-COMPOSITE 7



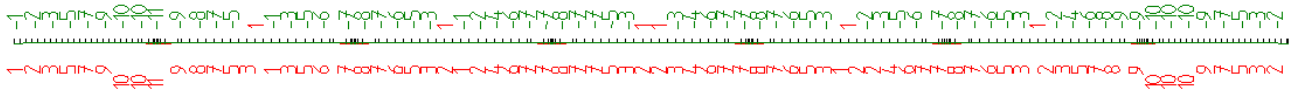
Nx(kN)-COMPOSITE 8



Nx(kN)-COMPOSITE 9

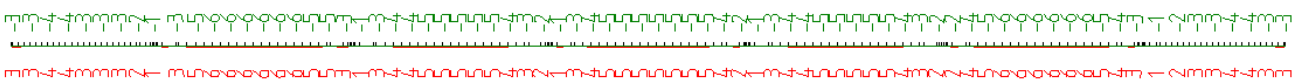


Nx(kN)-COMPOSITE 10

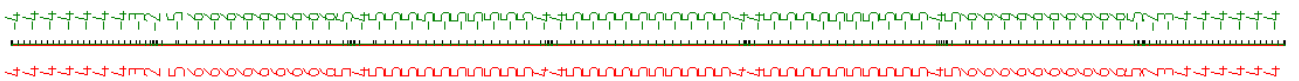


Composite-Brake.sup

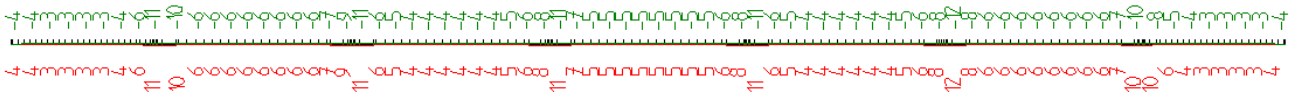
Qy(kN)-COMPOSITE 1



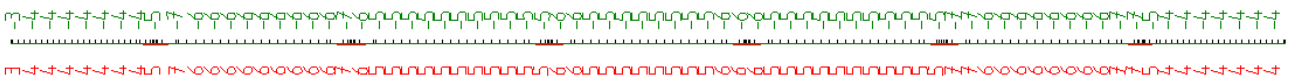
Qy(kN)-COMPOSITE 2



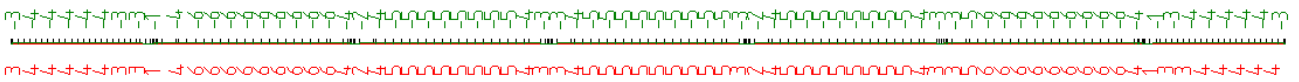
Qy(kN))-COMPOSITE 3



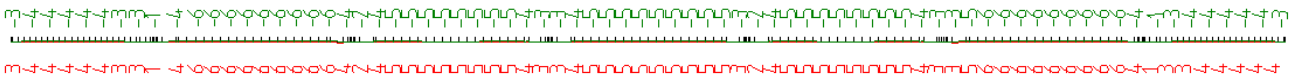
Qy(kN)-COMPOSITE 4



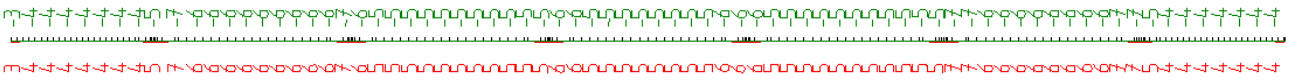
Qy(kN)-COMPOSITE 5



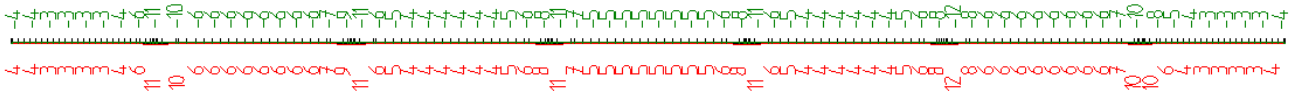
Qy(kN)-COMPOSITE 6



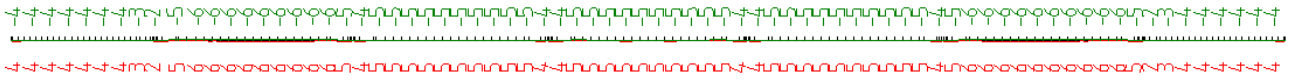
Qy(kN)-COMPOSITE 7



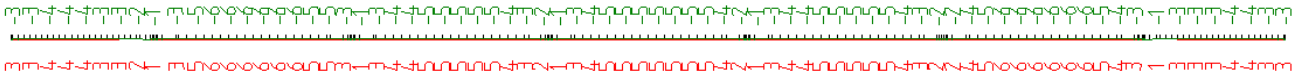
Qy(kN)-COMPOSITE 8



Qy(kN)-COMPOSITE 9



Qy(kN)-COMPOSITE 10



Composite-Temp-U.sup

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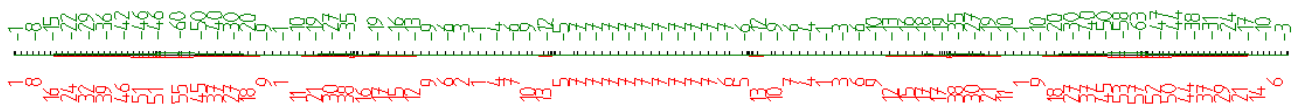
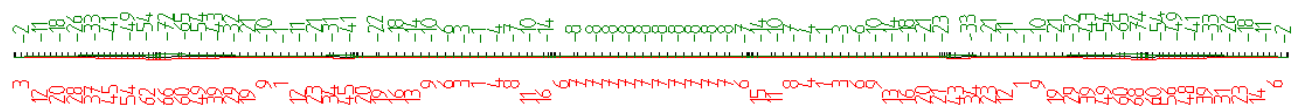
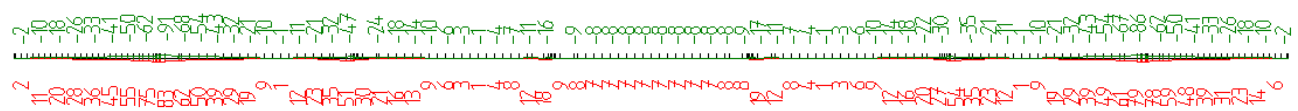


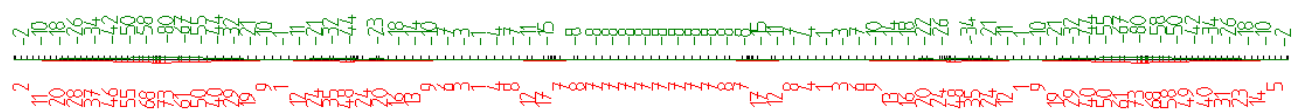
Mz(kNm)-COMPOSITE 2



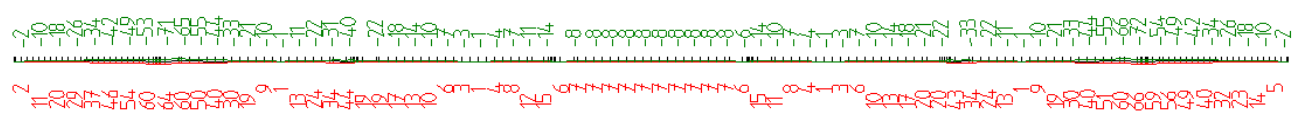
Mz(kNm)-COMPOSITE 3



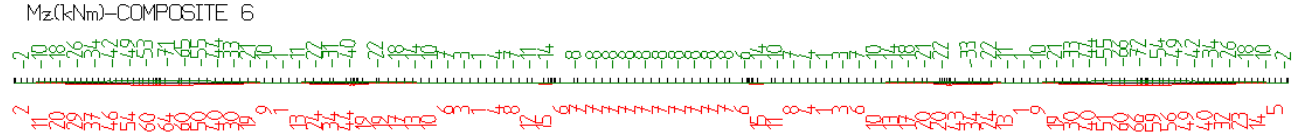
Mz(kNm)-COMPOSITE 4



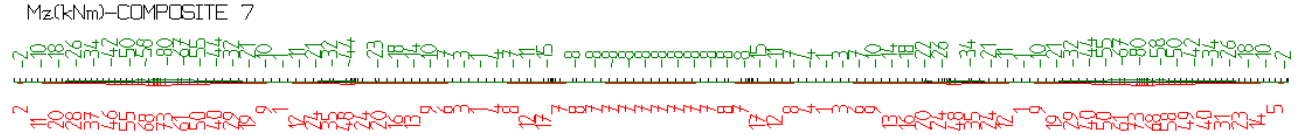
Mz(kNm)-COMPOSITE 5



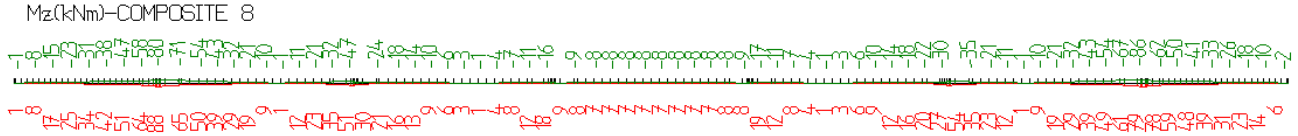
Mz(kNm)-COMPOSITE 6



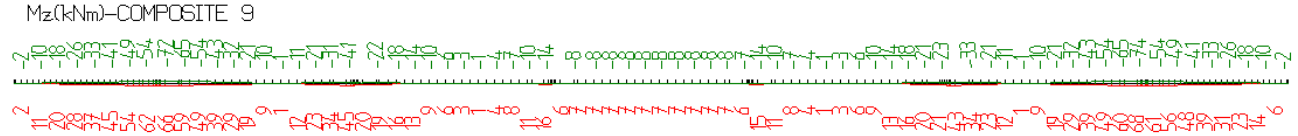
Mz(kNm)-COMPOSITE 7



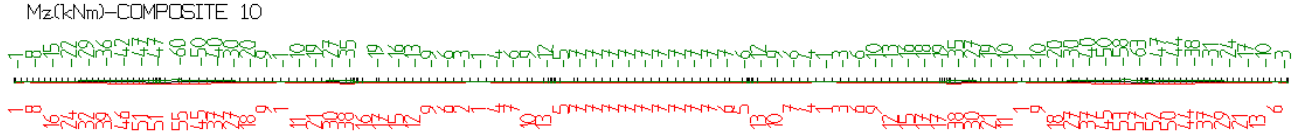
Mz(kNm)-COMPOSITE 8



Mz(kNm)-COMPOSITE 9

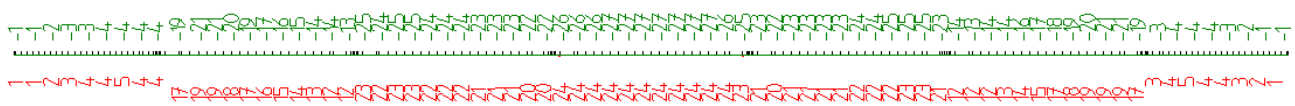


Mz(kNm)-COMPOSITE 10

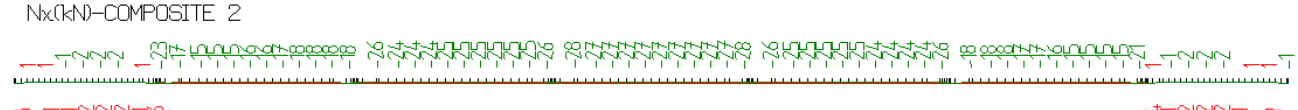


Composite-Temp-U.sup

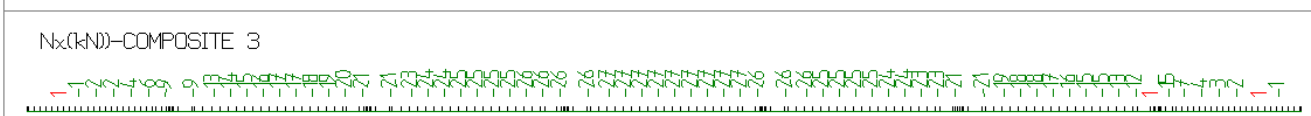
Nx(kN)-COMPOSITE 1



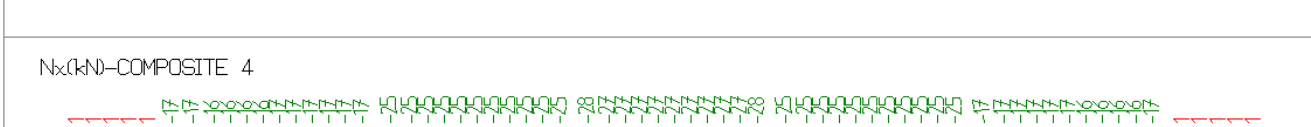
Nx(kN)-COMPOSITE 2



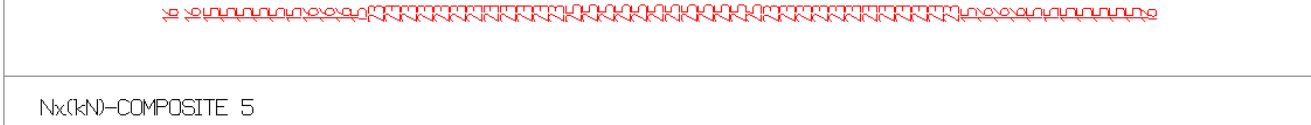
Nx(kN))-COMPOSITE 3



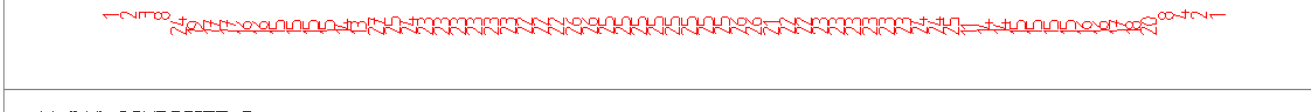
Nx(kN)-COMPOSITE 4



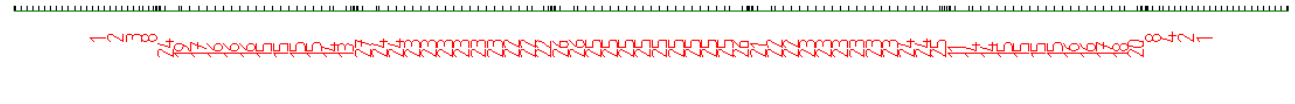
Nx(kN)-COMPOSITE 5



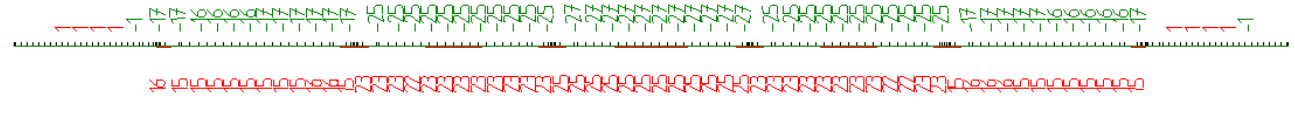
Nx(kN)-COMPOSITE 6



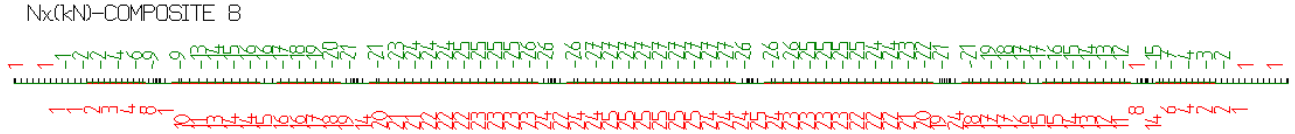
Nx(kN)-COMPOSITE 7



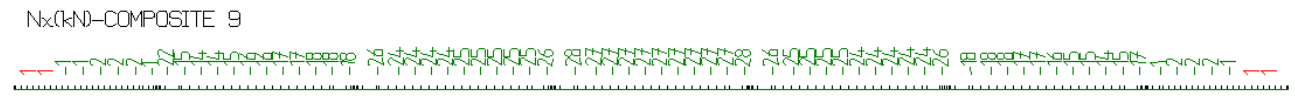
Nx(kN)-COMPOSITE 8



Nx(kN)-COMPOSITE 9



Nx(kN)-COMPOSITE 10

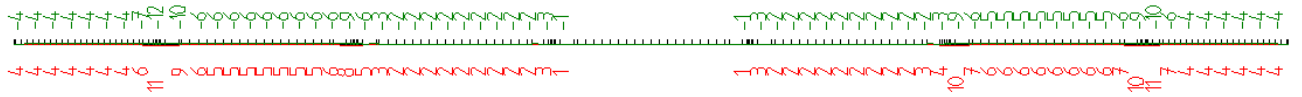


Composite-Temp-U.sup

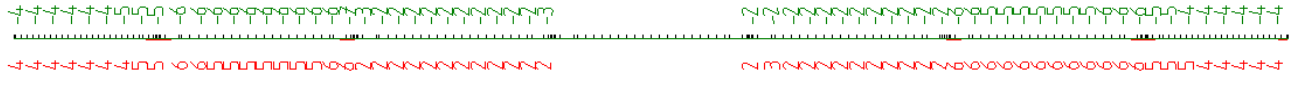
Qy(kN)-COMPOSITE 1

Qy(kN)-COMPOSITE 2

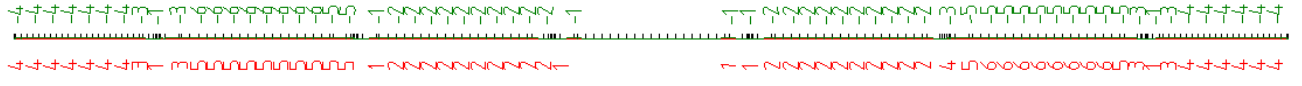
Qy(kN))-COMPOSITE 3



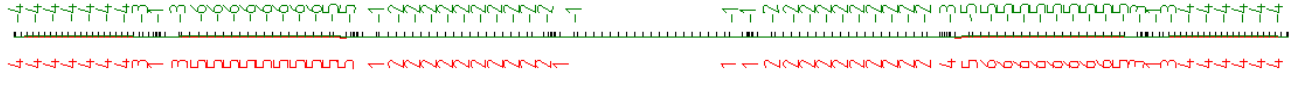
Qy(kN)-COMPOSITE 4



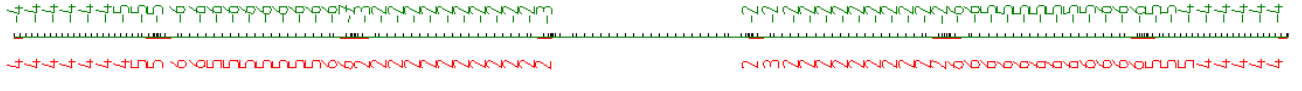
Qy(kN)-COMPOSITE 5



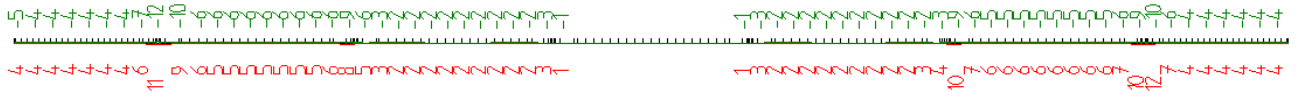
Qy(kN)-COMPOSITE 6



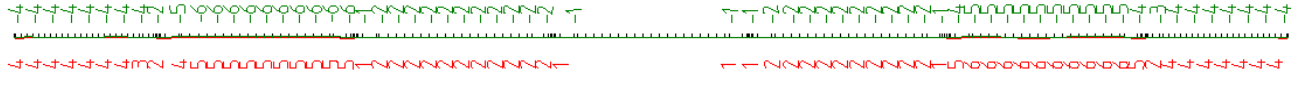
Qy(kN)-COMPOSITE 7



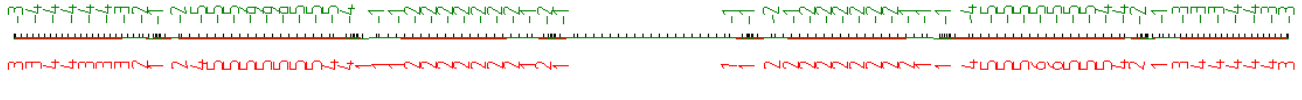
Qy(kN)-COMPOSITE 8



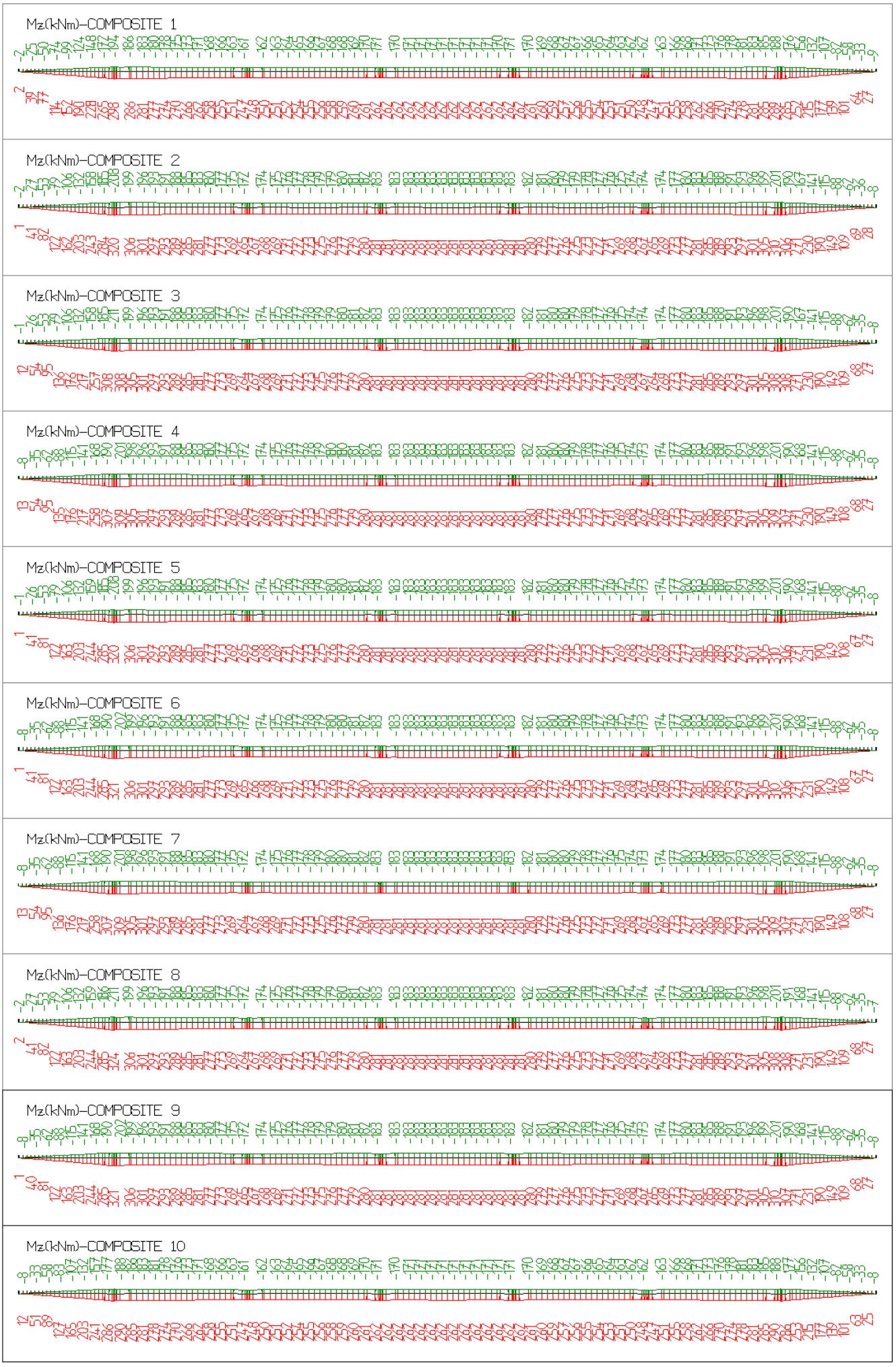
Qy(kN)-COMPOSITE 9



Qy(kN)-COMPOSITE 10

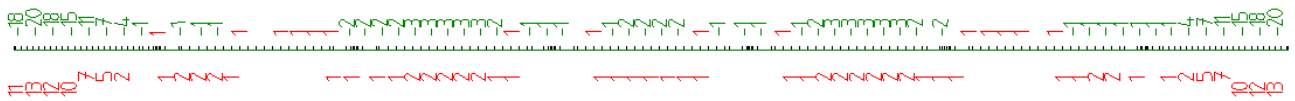


Composite-TempG.sup

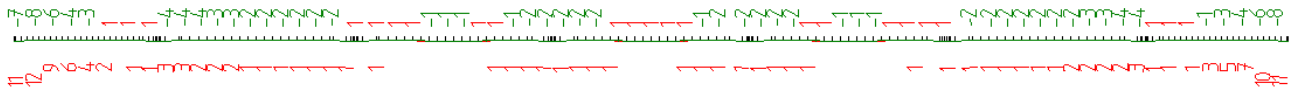


Composite-TempG.sup

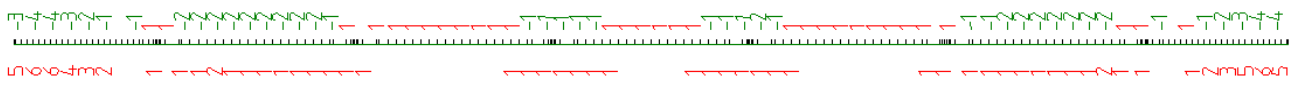
Nx(kN)-COMPOSITE 1



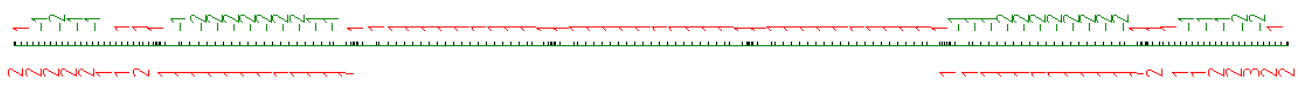
Nx(kN)-COMPOSITE 2



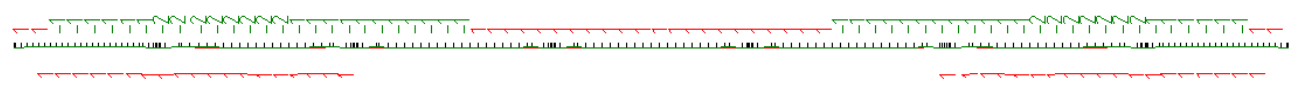
Nx(kN))-COMPOSITE 3



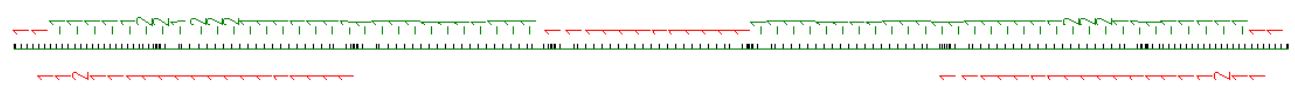
Nx(kN)-COMPOSITE 4



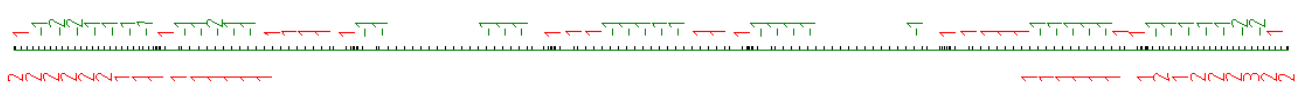
Nx(kN)-COMPOSITE 5



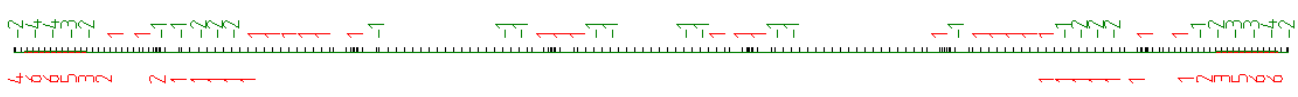
Nx(kN)-COMPOSITE 6



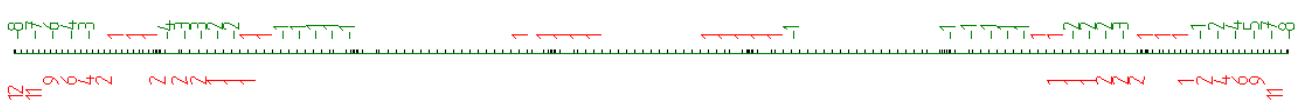
Nx(kN)-COMPOSITE 7



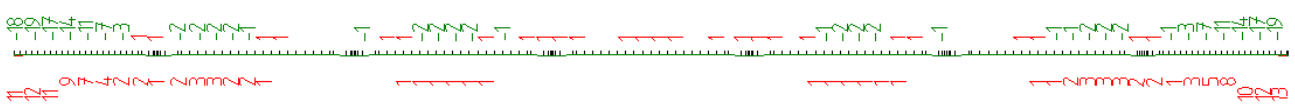
Nx(kN)-COMPOSITE 8



Nx(kN)-COMPOSITE 9



Nx(kN)-COMPOSITE 10



Composite-TempG.sup

Qy(kN)-COMPOSITE 1

Qy(kN)-COMPOSITE 2

Qy(kN))-COMPOSITE 3

Qy(kN)-COMPOSITE 4

Qy(kN)-COMPOSITE 5

Qy(kN)-COMPOSITE 6

Qy(kN)-COMPOSITE 7

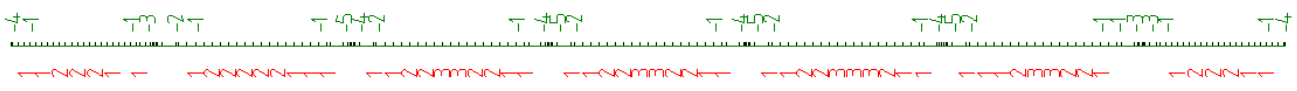
Qy(kN)-COMPOSITE 8

Qy(kN)-COMPOSITE 9

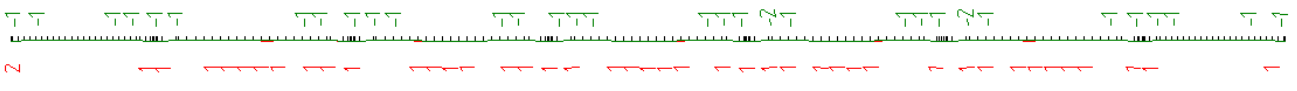
Qy(kN)-COMPOSITE 10

Composite-WindS+T.sup

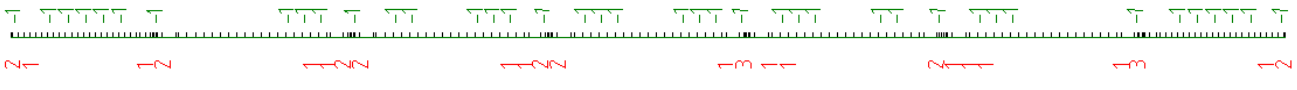
Mz(kNm)-COMPOSITE 1



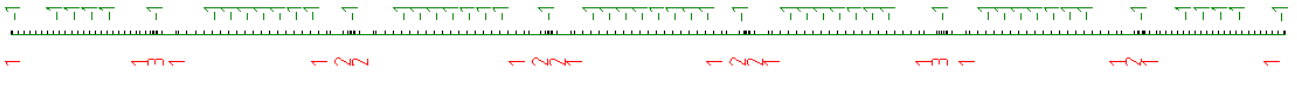
Mz(kNm)-COMPOSITE 2



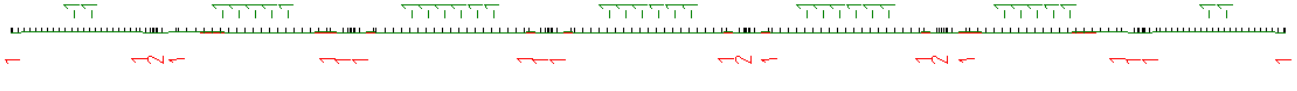
Mz(kNm)-COMPOSITE 3



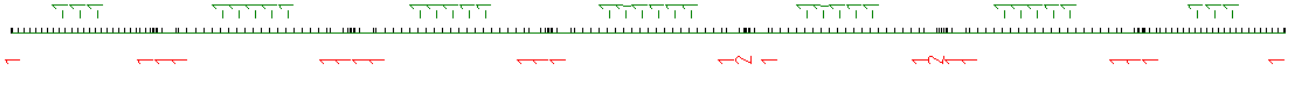
Mz(kNm)-COMPOSITE 4



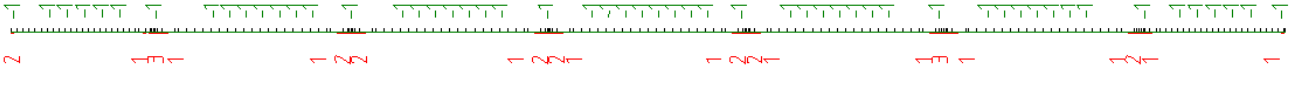
Mz(kNm)-COMPOSITE 5



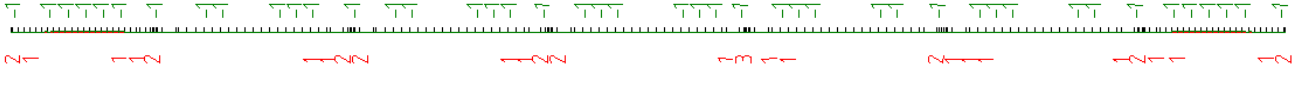
Mz(kNm)-COMPOSITE 6



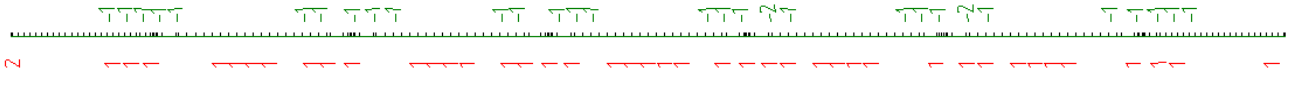
Mz(kNm)-COMPOSITE 7



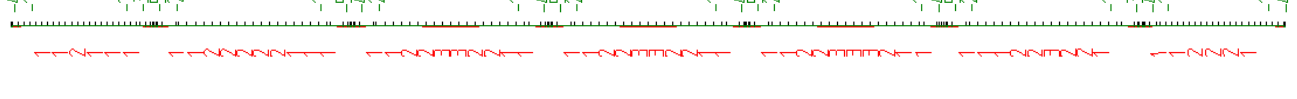
Mz(kNm)-COMPOSITE 8



Mz(kNm)-COMPOSITE 9

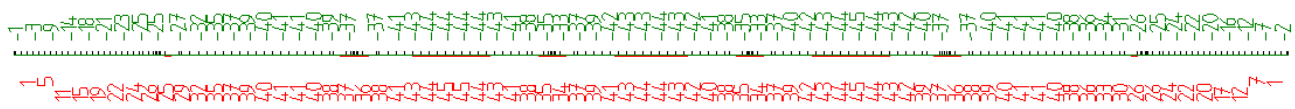


Mz(kNm)-COMPOSITE 10

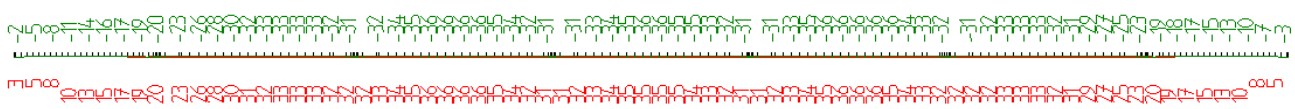


Composite-WindS+T.sup

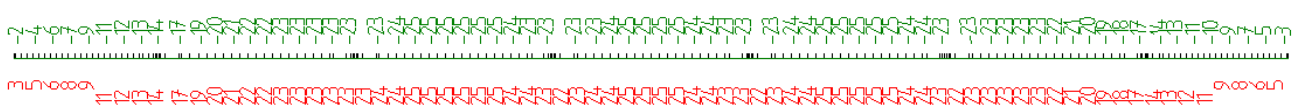
Nx(kN)-COMPOSITE 1



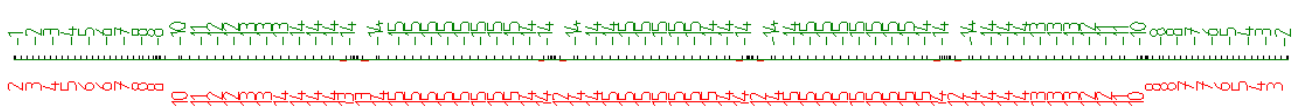
Nx(kN)-COMPOSITE 2



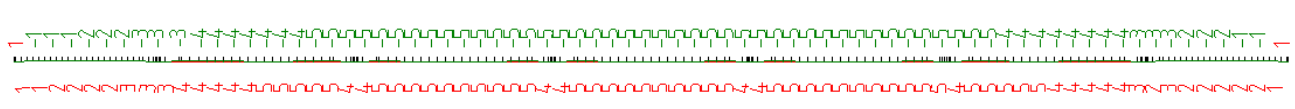
Nx(kN))-COMPOSITE 3



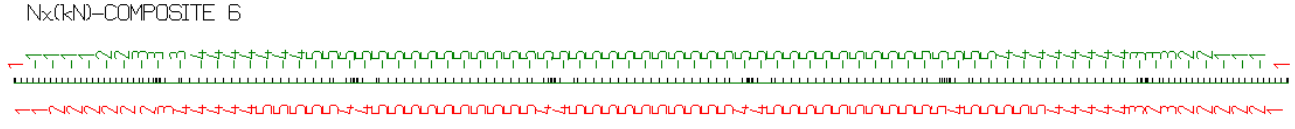
Nx(kN)-COMPOSITE 4



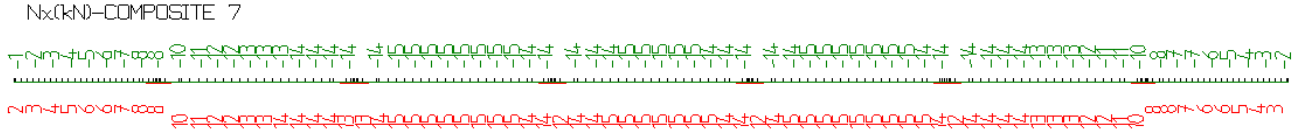
Nx(kN)-COMPOSITE 5



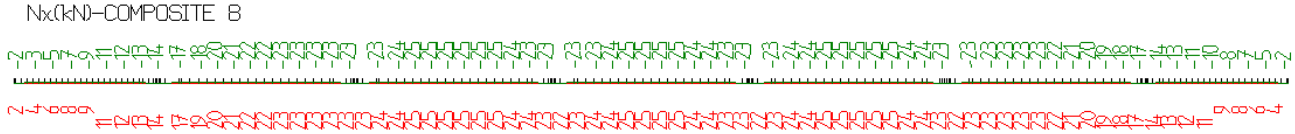
Nx(kN)-COMPOSITE 6



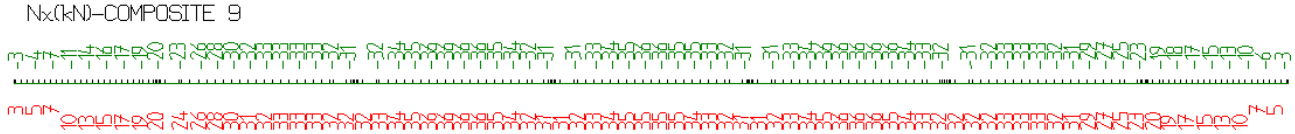
Nx(kN)-COMPOSITE 7



Nx(kN)-COMPOSITE 8



Nx(kN)-COMPOSITE 9



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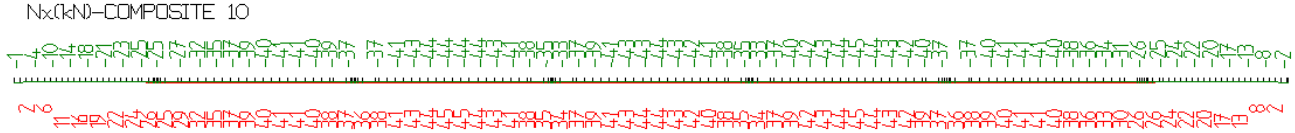

Composite-WindS+T.sup

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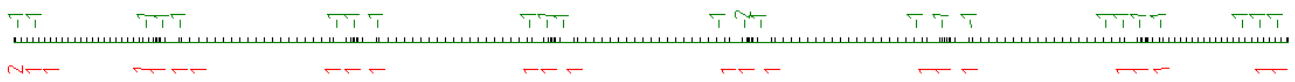
Qy(kN)-COMPOSITE 2

Qy(kN))-COMPOSITE 3



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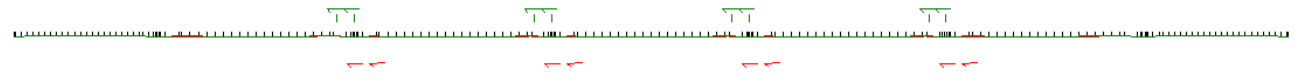
Qy(kN)-COMPOSITE 5



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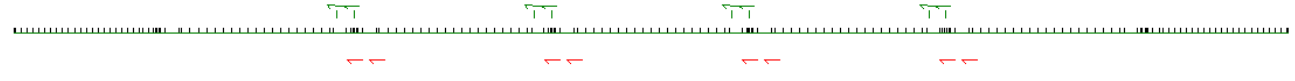

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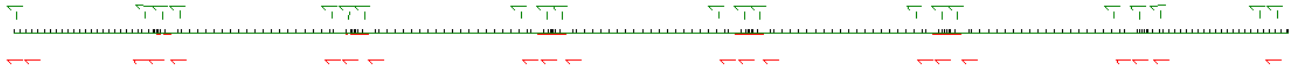

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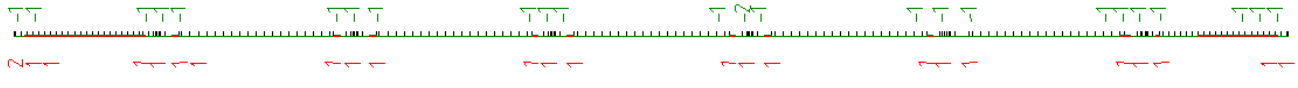

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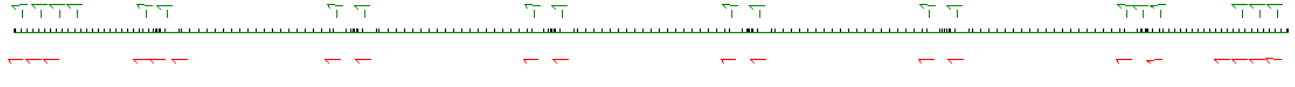

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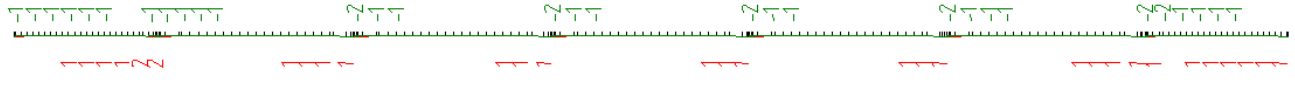

Composite-WindS-T.sup

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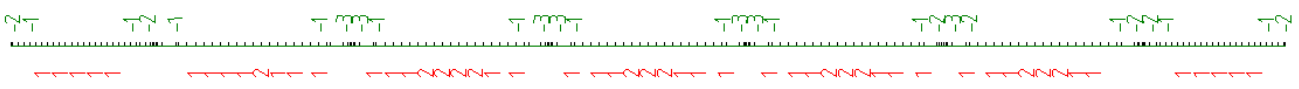

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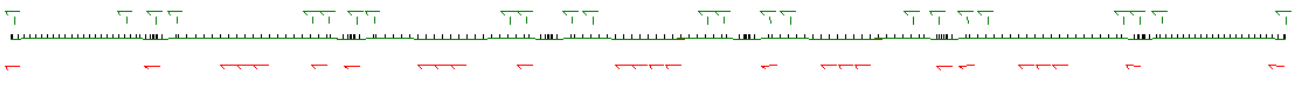

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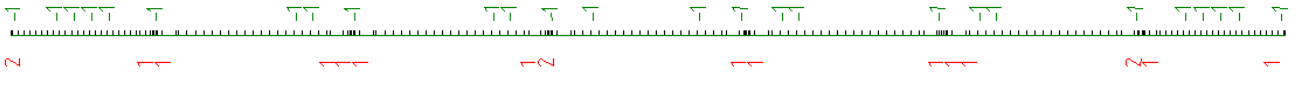
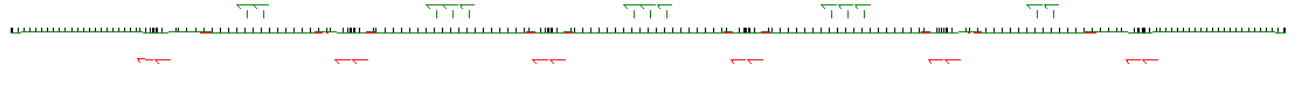


Mz(kNm)-COMPOSITE 4

Mz(kNm)-COMPOSITE 5



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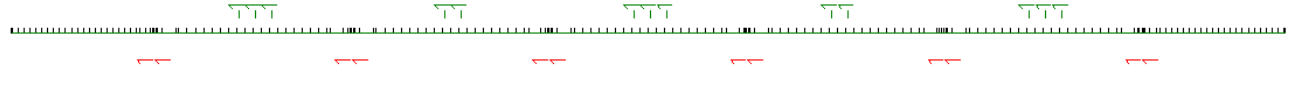

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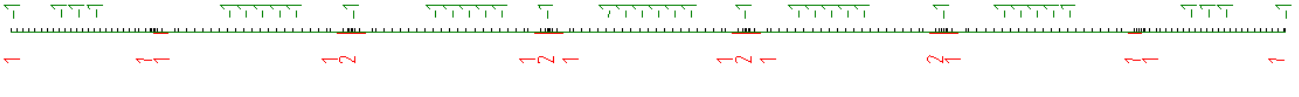

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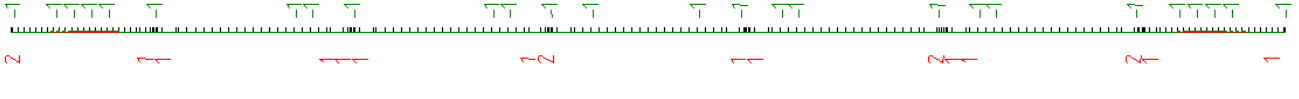

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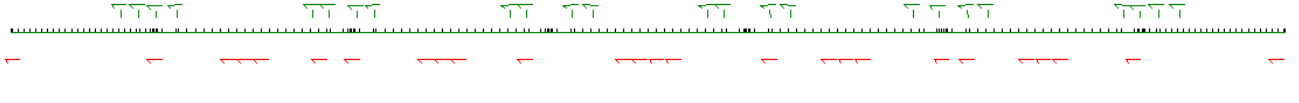
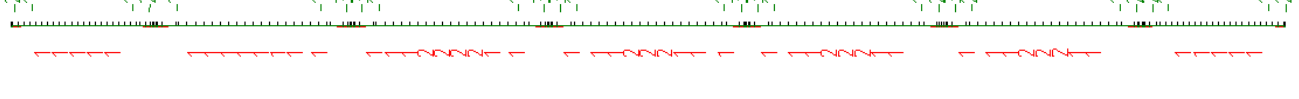
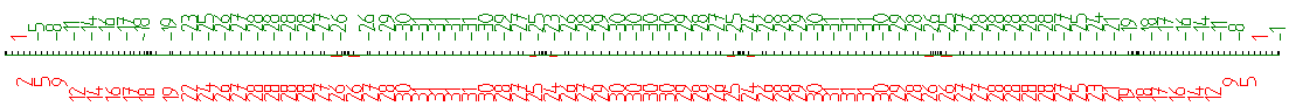


Mz(kNm)-COMPOSITE 10



Composite-WindS-T.sup

Nx(kN)-COMPOSITE 1



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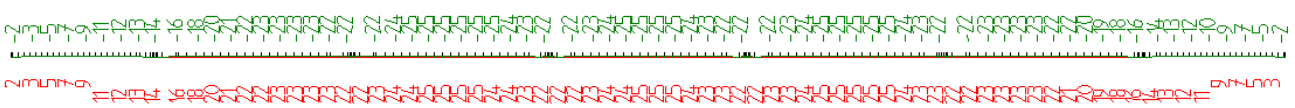
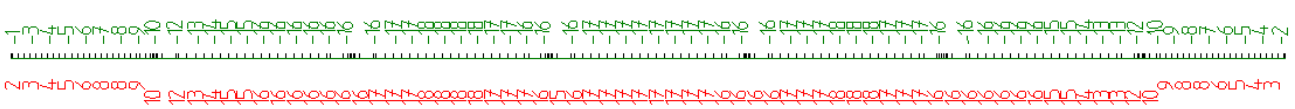


Nx(kN))-COMPOSITE 3



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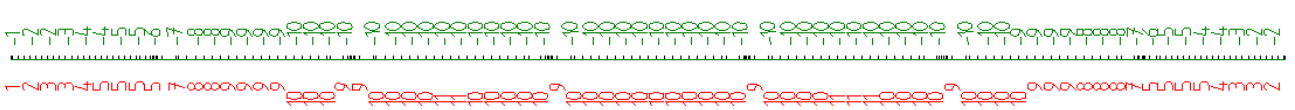

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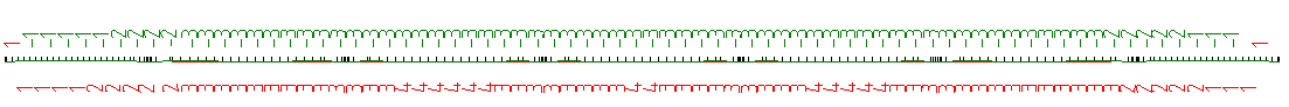
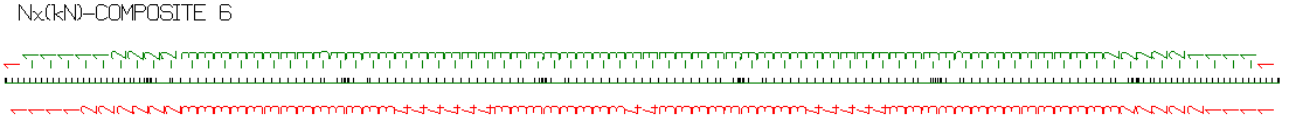


Nx(kN)-COMPOSITE 6



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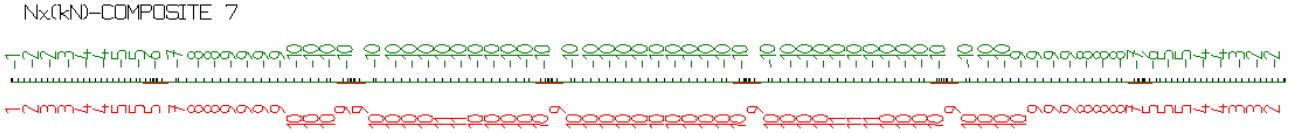

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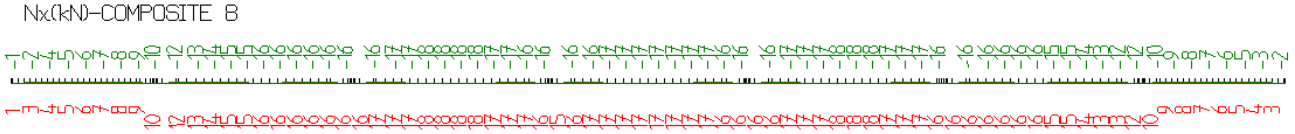

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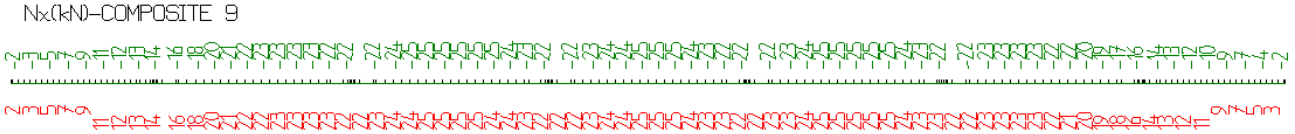

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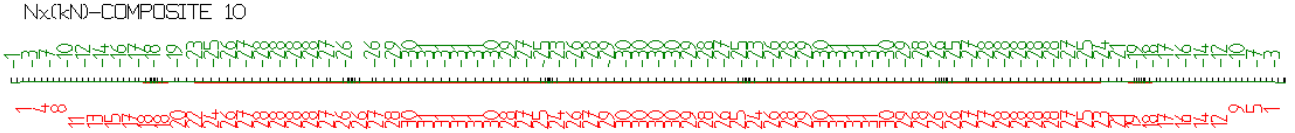


Composite-WindS-T.sup

Qy(kN)-COMPOSITE 1

Qy(kN)-COMPOSITE 2

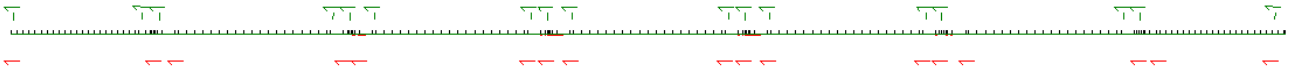
Qy(kN))-COMPOSITE 3

Qy(kN)-COMPOSITE 4

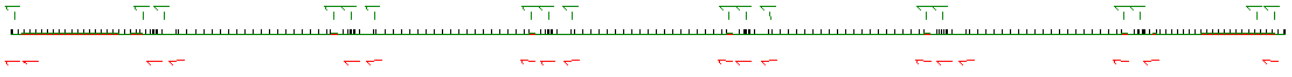
Qy(kN)-COMPOSITE 5

Qy(kN)-COMPOSITE 6

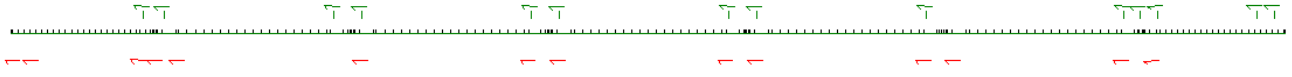
Qy(kN)-COMPOSITE 7



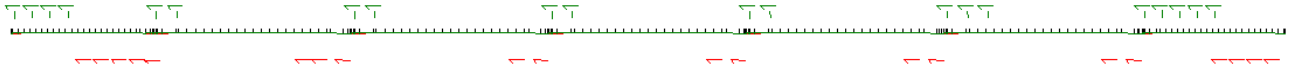
Qy(kN)-COMPOSITE 8



Qy(kN)-COMPOSITE 9



Qy(kN)-COMPOSITE 10



ФАЗА ГРАДЊЕ – ДИЈАГРАМИ НАПОНА

/Stage one – stresses

Сумирани приказ комбинација за проверу напона и угиба у фази градње /summation of combination used for stress check:

Load Case	Comb 01	Comb 02	Comb 03
	Construction stage		
	Girders	STG1	Final
Girder SW	1/1	1/1	
Precst-PT	1/1	1/1	
Girder-CS	1/1	1/1	
Precst-CS	1/1	1/1	
Onsite-FW		1/1	
Onsite-SW			
Onsite-CS			
SUM-SW			1/1
SUM-PT			1/1
SDL			1/1
CS			1/1
CSinf			1/1

Girder-SW – **сопствена тежина монтажног носача /**girder self weight

Precast-PT – **утицаји од преднапрезања /**prestressing actions

Girder-CS – **скупљање и течење монтажног носача /** girder creep and shrinkage

Precast-CS – **временски утицаји у ужадима /**tendons relaxation

Onsite-SW – **тежина добетониране плоче /**wet concrete self weight

SUM-SW – **тежина целе конструкције /** self weight summation

SUM-PT – **утезање ужади /**prestressing summation

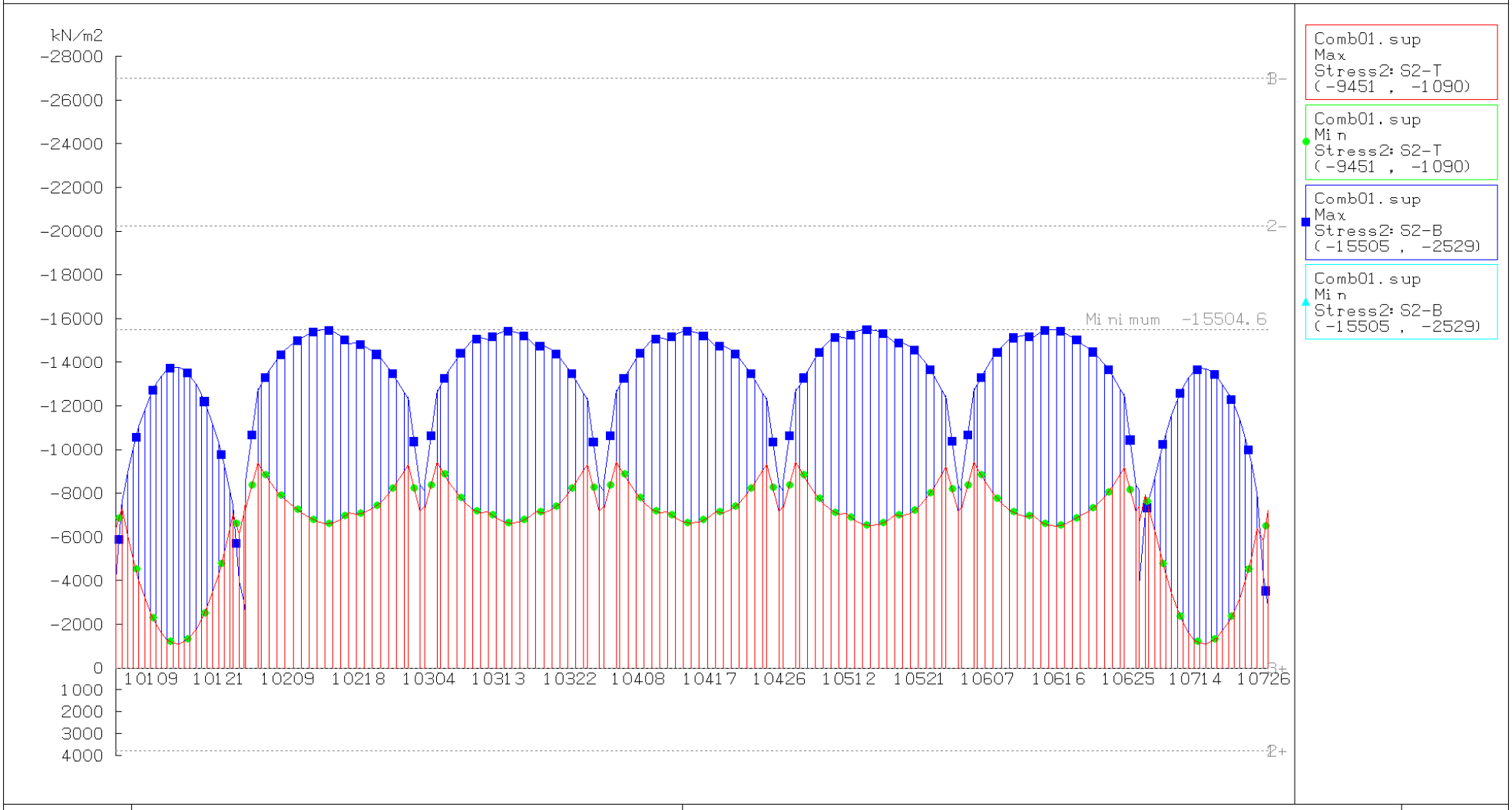
SDL – **додатно стално оптерећење /**superimposed dead load

CS – **скупљање и течење у тренутку t0/**creep and shrinkage t=0

CSinf – **скупљање и течење t∞**/creep and shrinkage t∞

1/1 **– повољно/неповољно дејство оптерећења** /favoruable and unfavoruable case of action

Следи приказ дијаграма напонског стања за комбинације 1, 2 и 3 у монтажном носачу / Following are the stress diagrams for cominations 1,2 and 3 in the main girder



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

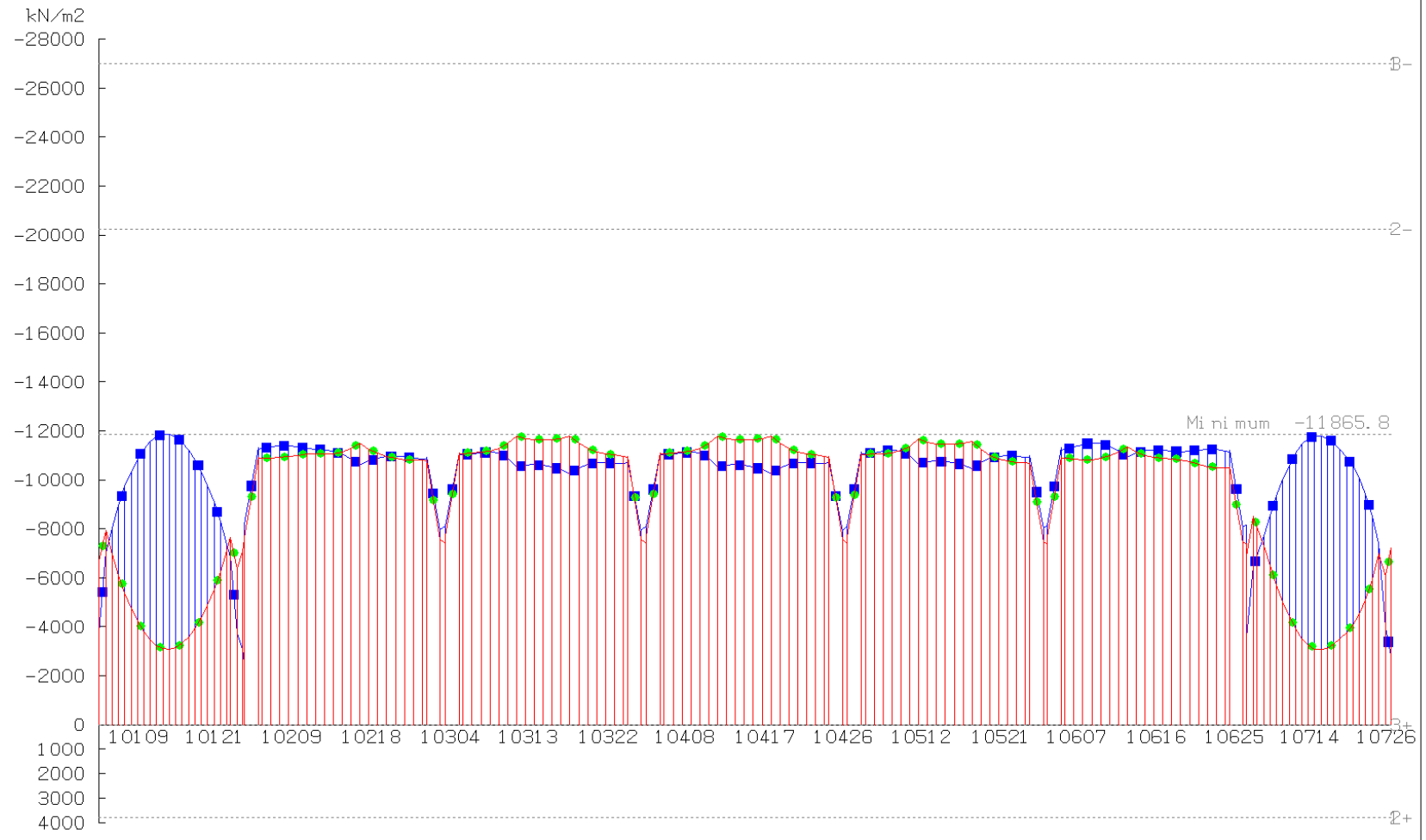
RmSet: FG-Gird1-Comb1

FG-Gird1-Comb1

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
15:32



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: FG-Gird1-Comb2

FG-Gird1-Comb2

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
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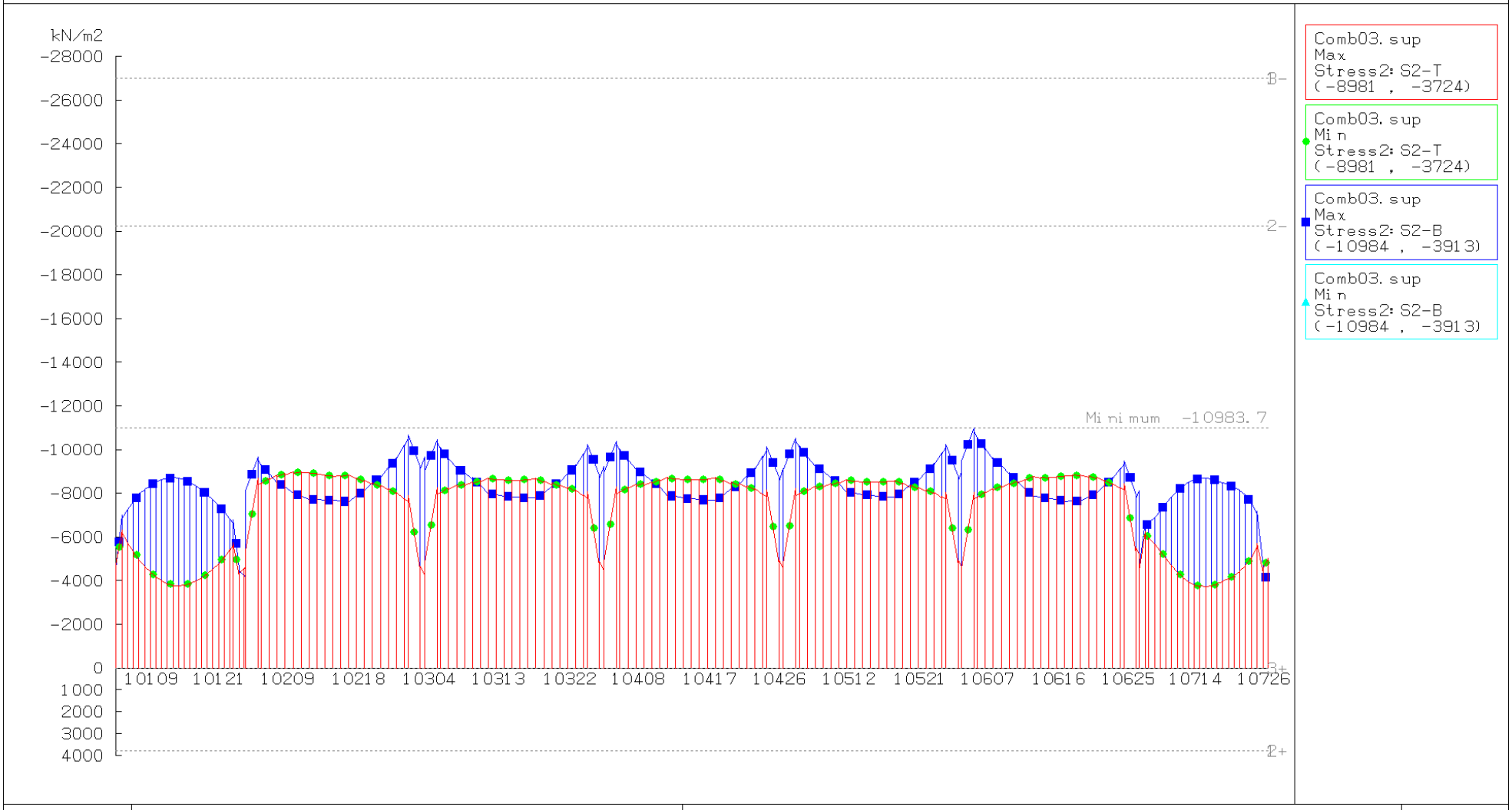

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: FG-Gird1-Comb3

FG-Gird1-Comb3

1 cm Plot = 2439.6 kN/m2

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19/07/2021
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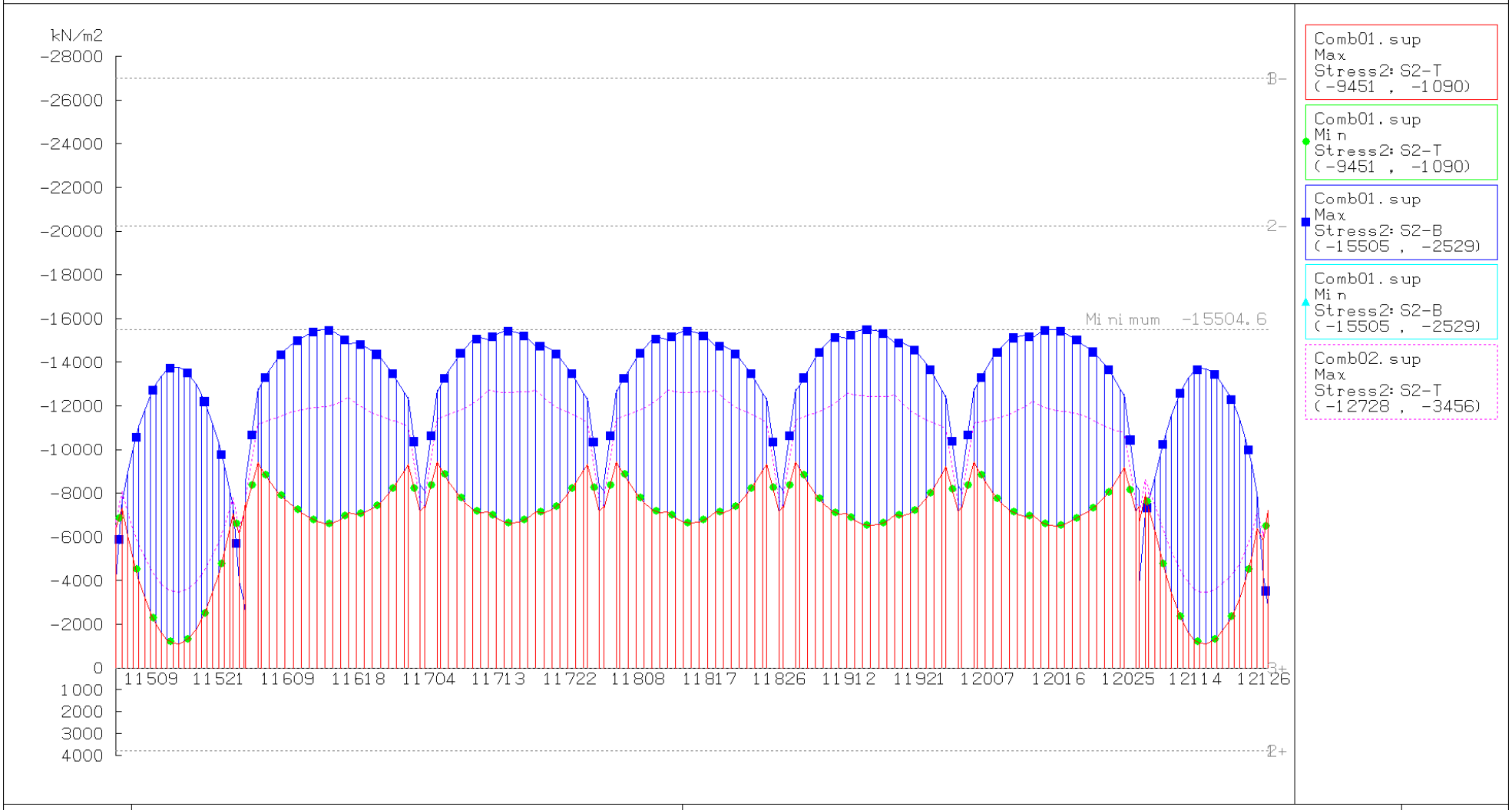


RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

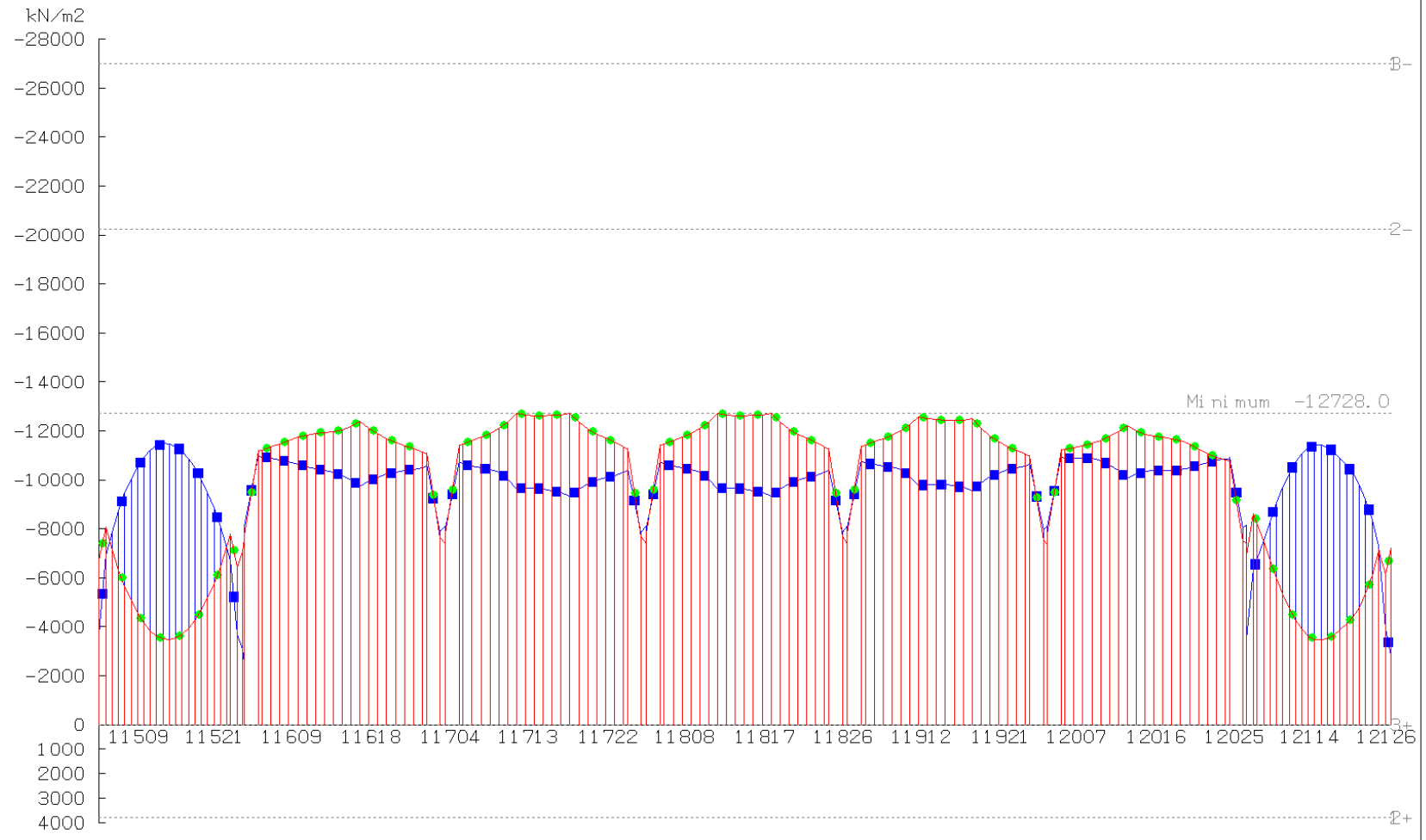
RmSet: FG-Gird3-Comb1

FG-Gird3-Comb1

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
15:33



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

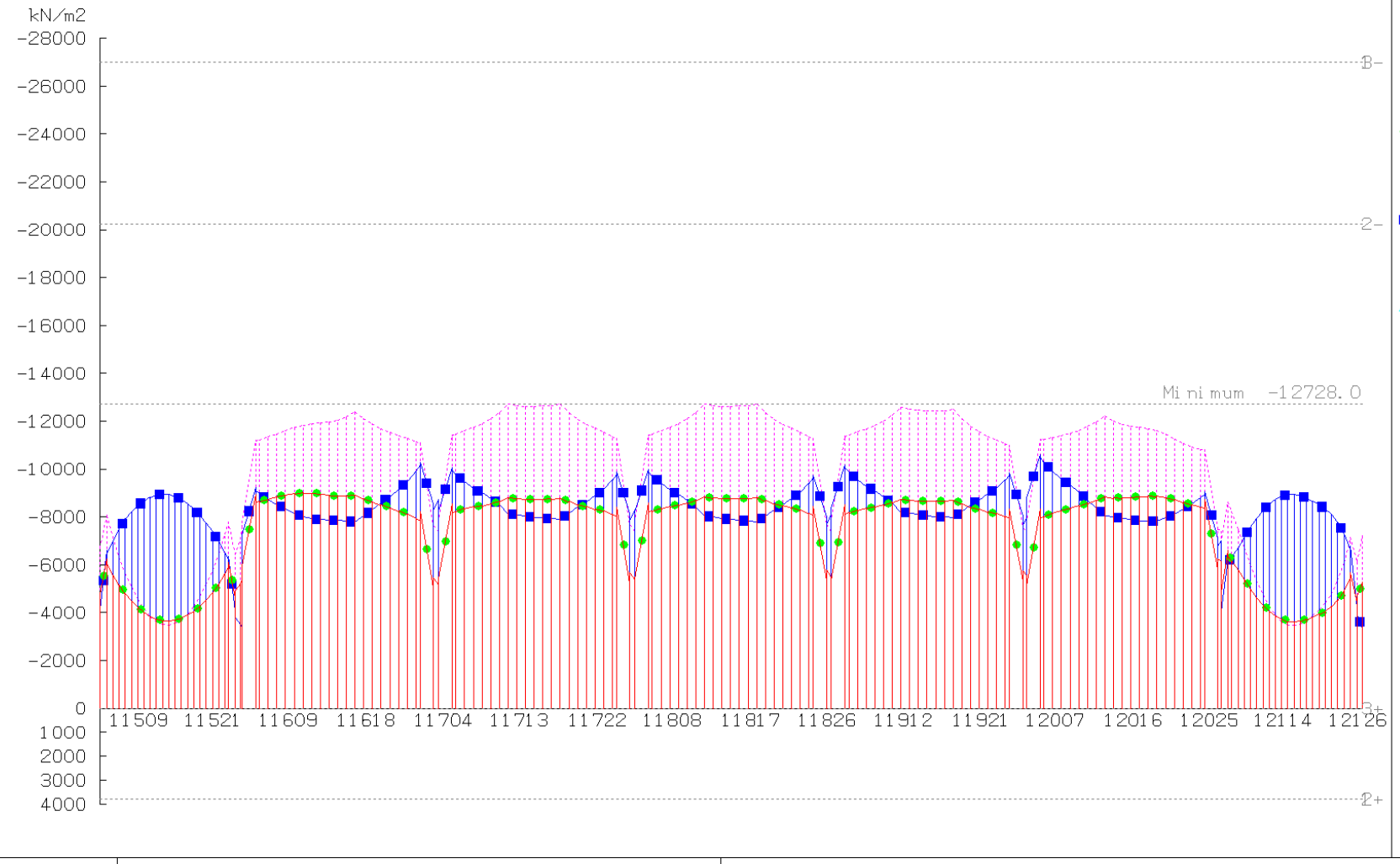
RmSet: FG-Gird3-Comb2

FG-Gird3-Comb2

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
15:33



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: FG-Gird3-Comb3

FG-Gird3-Comb3

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
15:33

Карактеристичне, честе и квази сталне комбинације – контрола напона

Контролише се напон у бетону и челику.

Следи контрола напона по EC2, за гранична стања употребљивости која подразумева:

- Напоне притиска у бетону – карактеристична комбинација $\sigma_c \leq 0.6\, f_{ck}$
- Напоне затезања у бетону - карактеристична комбинација $\sigma_c > -\, f_{ctm}$
- Контрола декомпресије – честа комбинација $\sigma_c < 0$
- Контрола линеарног течења бетона - квази-стална кмбинација $\sigma_c \leq 0.45\, f_{ck}$
- Контрола у преднапрегнутом челику – карактеристична комбинација $\sigma_p \leq 0.75\, f_{pk}$
- Контрола напона у арматурном челику – карактеристична комбинација $\sigma_s \leq 0.8\, f_{yk}$

Превелики напон притиска у бетону може да изазове подужне прслине и микропрслине, што смањује трајност конструкције. Граница од $0.6\, f_{ck}$ користи се за избегавање ових појава.

Избор модела пресека (са прслином или без) зависи од појаве затезања које прелази допуштену границу. Употреба попречних пресека без прслине могућа је уколико је обезбеђено да напони затезања при савијању нису већи од $f_{ct,eff}$ ($f_{ct,eff} = f_{ctm}$).

Напон од $0.45\, f_{ck}$ се ограничава како не би дошло до већих деформација течења када би требало узети у обзир у порачун и нелинеарне ефекте понашања.

Границом декомпресије се захтева да су сви делови каблова који приањају са бетоном или цеви за каблове, постављени најмање 100 mm унутар притиснутог бетона.

Дат је табеларни приказ меродавних максималних и минималних напона по носачима и закључено да ли задовољавају прописане граничне вредности.

У наставку приложени су дијаграми напона за сваки носач у свим пољима. За задате улазне податке приказа максималне или минималне вредности напона (у математичком смислу), и дефинисања горње или доње ивице пресека, софтверски пакет израчунава и приказује меродавне вредности напона. Напони притиска су обележени са знаком минус испред броја, а напони затезања су позитивне цифре.

Приказане су комбинације које улазе у карактеристичну, честу и квази сталну анвелопу.

Characteristic, frequent and quasi permanent combinations – stress checks

Stress check is done for concrete and steel elements(tendons and reinforcement).

Following are listed stress checks:

- Concrete compressive stress – characteristic combination $\sigma_c \leq 0.6\ f_{ck}$
- Concrete tensile stresses - characteristic combination $\sigma_c > -\ f_{ctm}$
- Decompression checks – frequent combination $\sigma_c < 0$
- Linear creep check – quasi-permanent combination $\sigma_c \leq 0.45\ f_{ck}$
- Stressing in pre-stressing tendons– characteristic combination $\sigma_p \leq 0.75\ f_{pk}$
- Reinforcement tensile stresses – karakteristična kombinacija $\sigma_s \leq 0.8\ f_{yk}$

For prevention of longitudinal cracking, which can lead to reduction of durability, the compressive stresses are limited to $0.6\ f_{ck}$.

Eurocode allows uncracked sections to be used provided the peak tensile stress does not exceed the effective tensile strength of the section $f_{ct,eff}$ ($f_{ct,eff} = f_{ctm}$).

If the stress limit $0.45\ f_{ck}$ is exceeded the creep deformations are high and non-linear creep should be considered.

The decompression limit check requires that no tensile stresses occur in any concrete within a distance of 100 mm, according to serbian national annex, of the tendon or its duct.

Summation of all mentioned stress checks, maximum and minimul values for every girder, are listed in table and concluted satisfing.

Following diagrams show stress state in all girders in all spans. One diagram for one girder through all spans. For given input data software calculates maximum and minimum stresses in top and bottom fiber for all leading component, max Nx, max Mz, min Nx, min Mz etc. Compressive stresses are negative numbers, and tensile are positive one.
Also, tables for characteristic, frequent and quasi-permanent envelopes of combinations are presented in following pages.

4.4.2.1. Напони притиска у бетону

Compressive stresses in concrete

ЛЕГЕНДА /LEGEND:

Stress2:S2-T(max/min) - **максимални и минимални напони у горњем влакну** / Maximum and minimum values at top fiber

Stress2:S2-B(max/min) - **максимални и минимални напони у доњем влакну** / Maximum and minimum values at bottom fiber

Напони притиска у бетону/Concrete compressive strength						
SLS-charac - σc ≥ -0.60*fck						
fck=	45	MPa	→	0.6*fck=	27	MPa

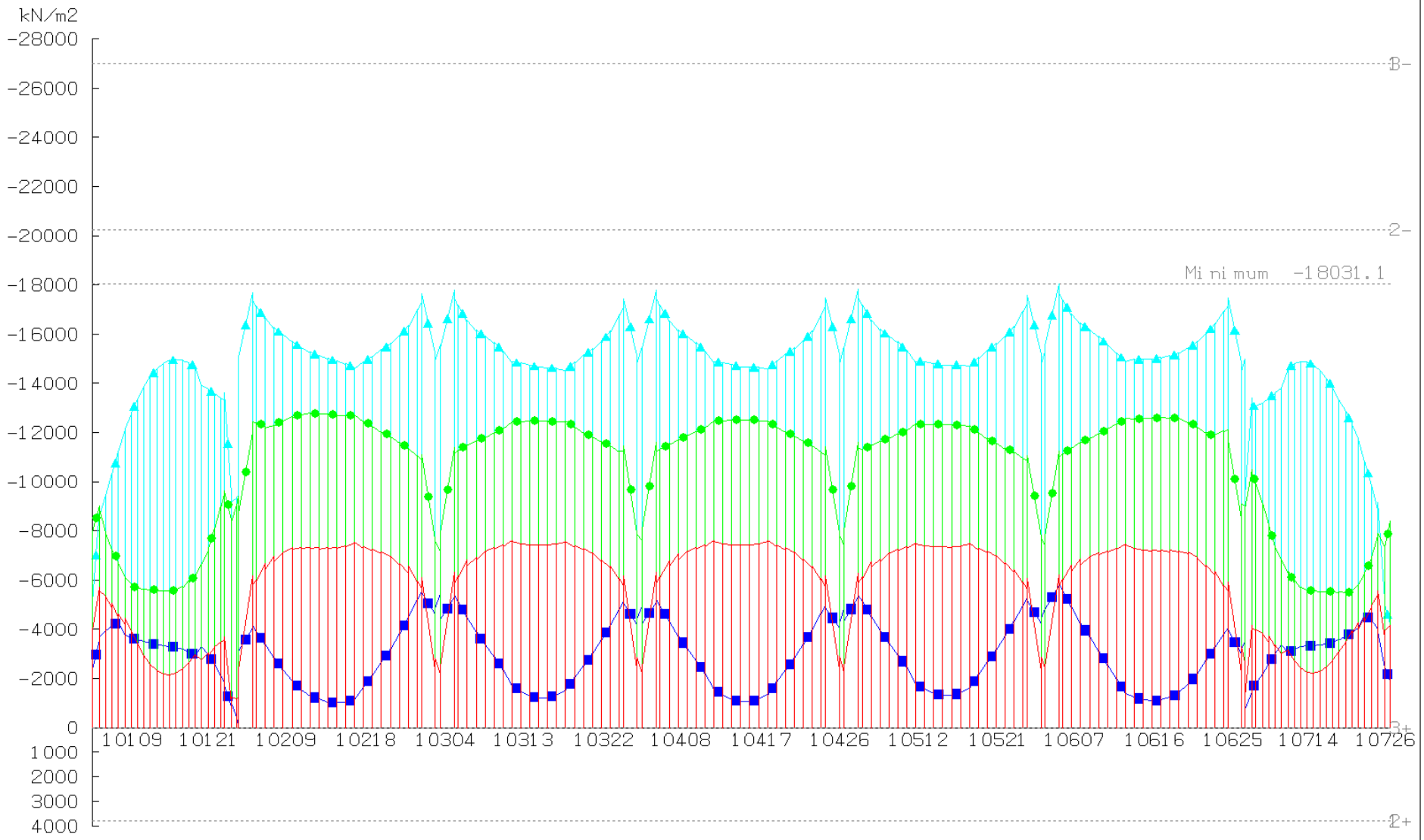
Сумирани приказ карактеристичних комбинација које улазе у анвелопу за проверу граничног стања употребљивости (SLS-characteristic)/

Characteristic combinations for SLS check**:**

rule	Load Case	Stages			SLS												
		Comb 01	Comb 02	Comb 03	Comb 04	Comb 05	Comb 06	Comb 07	Comb 08	Comb 09	Comb 10	Comb 11	Comb 12	Comb 13	Comb 14	Comb 15	Comb 16
		Construction stage			characteristic												
		Girders	STG1	Final	gr1					gr1		gr1				gr2	
Add	SUM-SW			1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Add	SUM-PT			1/1	1/1	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10
Add	SDL			1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Add	CS			1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Add	CSinf			1/1			1/1		1/1		1/1		1/1		1/1		1/1
And	Csinf				1												
And	LM1-TS				1	1	1	1	1	0.75	0.75	0.75	0.75			0.75	0.75
And	LM1-UDL				1	1	1	1	1	0.40	0.40	0.40	0.40			0.40	0.40
And	Pedestrian Load 3kN/m^2				1	1	1	1	1	0.40	0.40	0.40	0.40			0.40	0.40
And	Traction and breaking															1	1
And	FLM3																
And	Wind without traffic													1	1		
And	Wind with traffic							0.60	0.60			1	1				
And	Thermal				0.60	0.60	0.60			1	1					0.60	0.60

Rule –

правило додавања оптерећења, безусловно или само за повољно дејство. Скупљање и течење се узима у оба случаја, као безусловно и као повољно дејство. Безусловно је са rule-add, повољно је са rule-and. / rule for adding loads into combinations, unconditionally ot only favoruable case. Creep and shrinkage is taken double, one combination is with unconditional case and other only for favourable effect.



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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird1, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G1

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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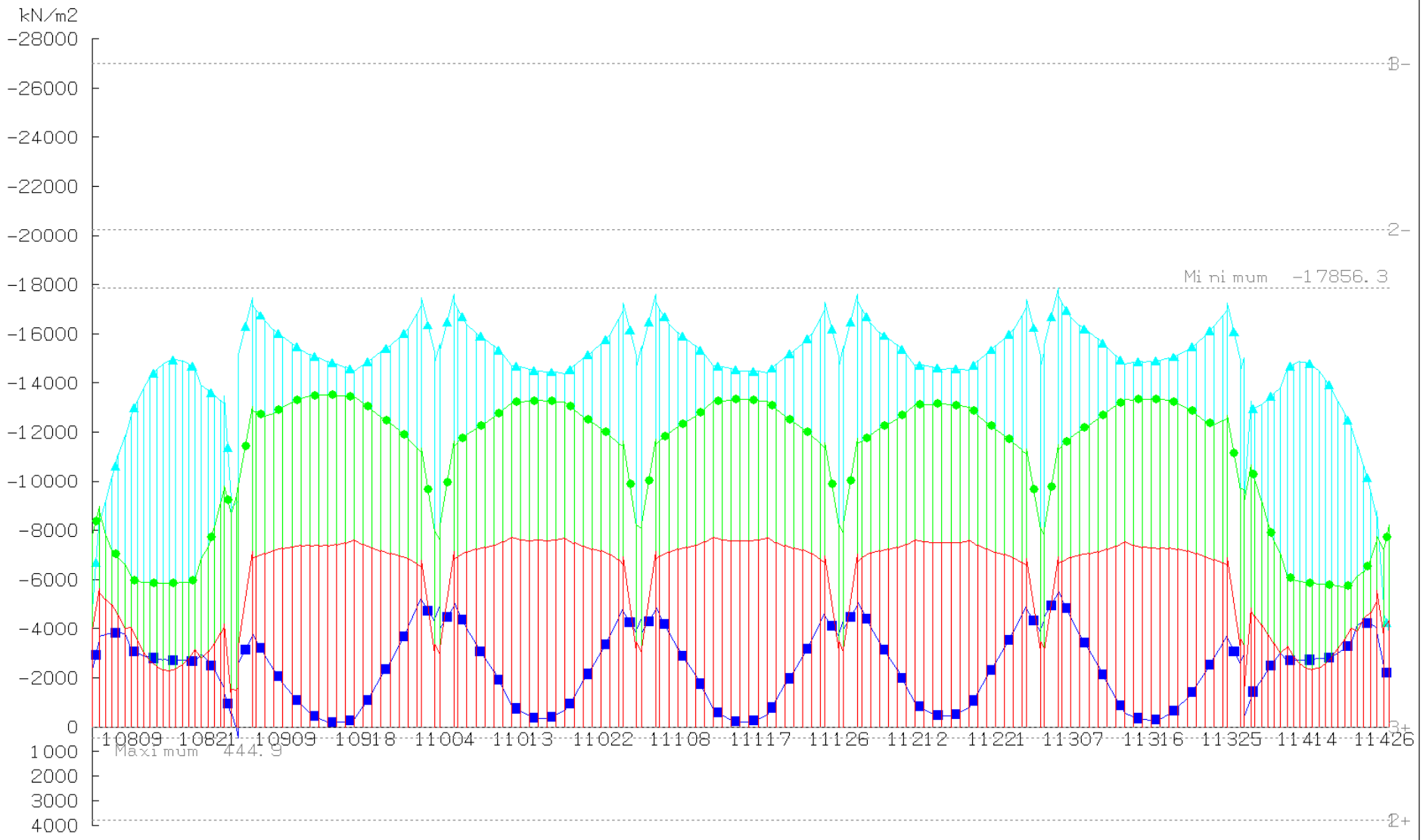
10:50



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Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird2, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G2

1 cm Plot = 2439.6 kN/m2

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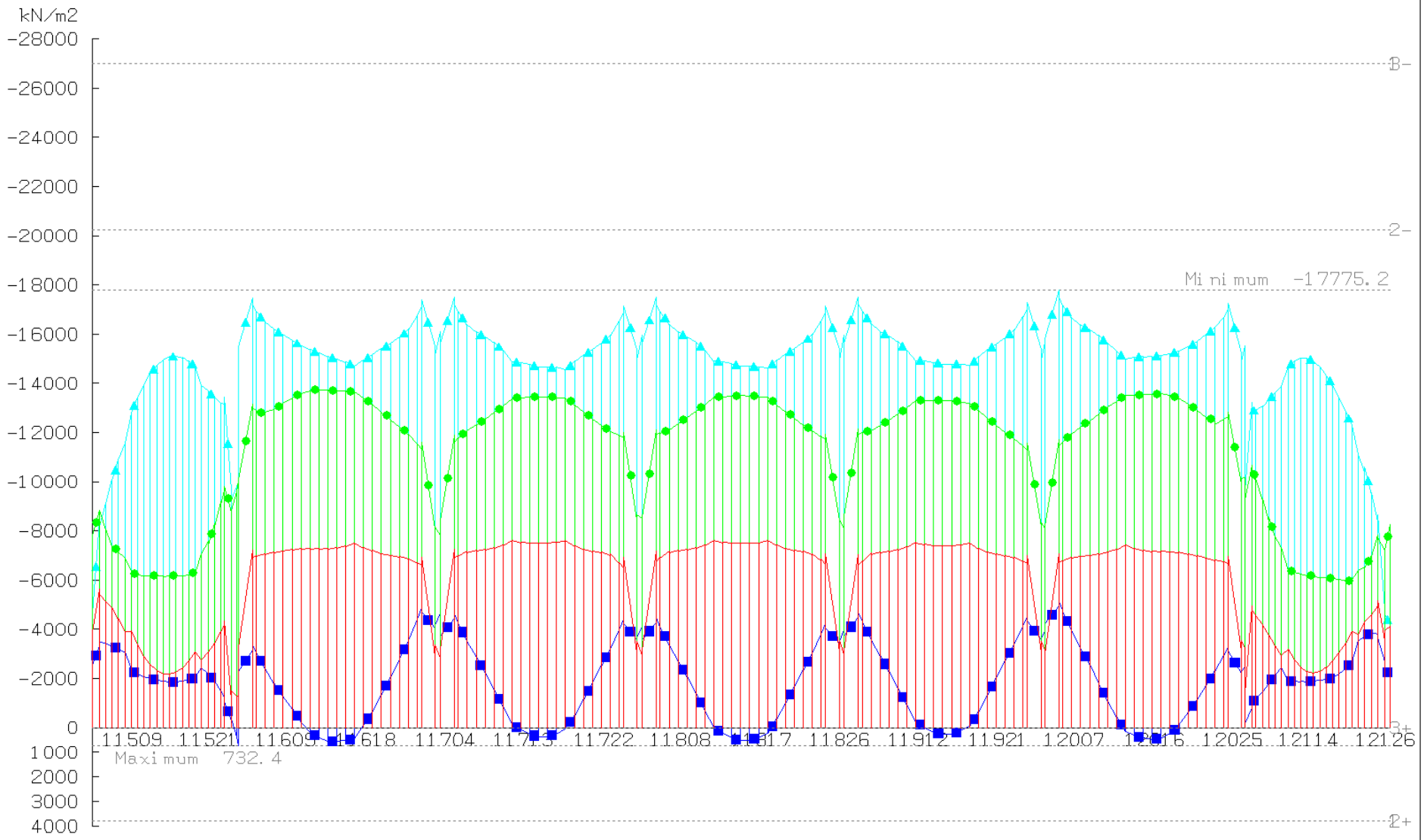

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Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird3, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G3

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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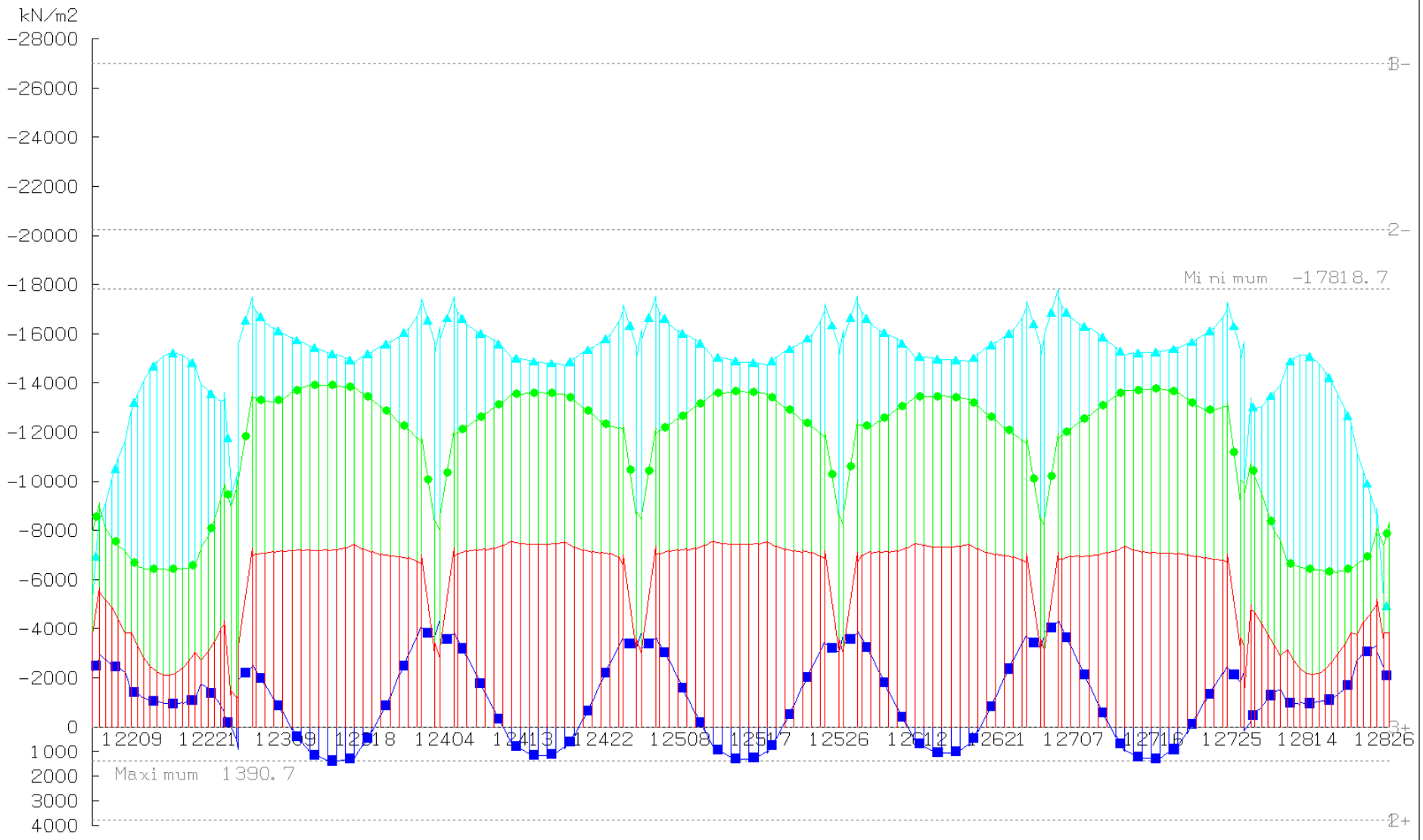

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Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird4, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G4

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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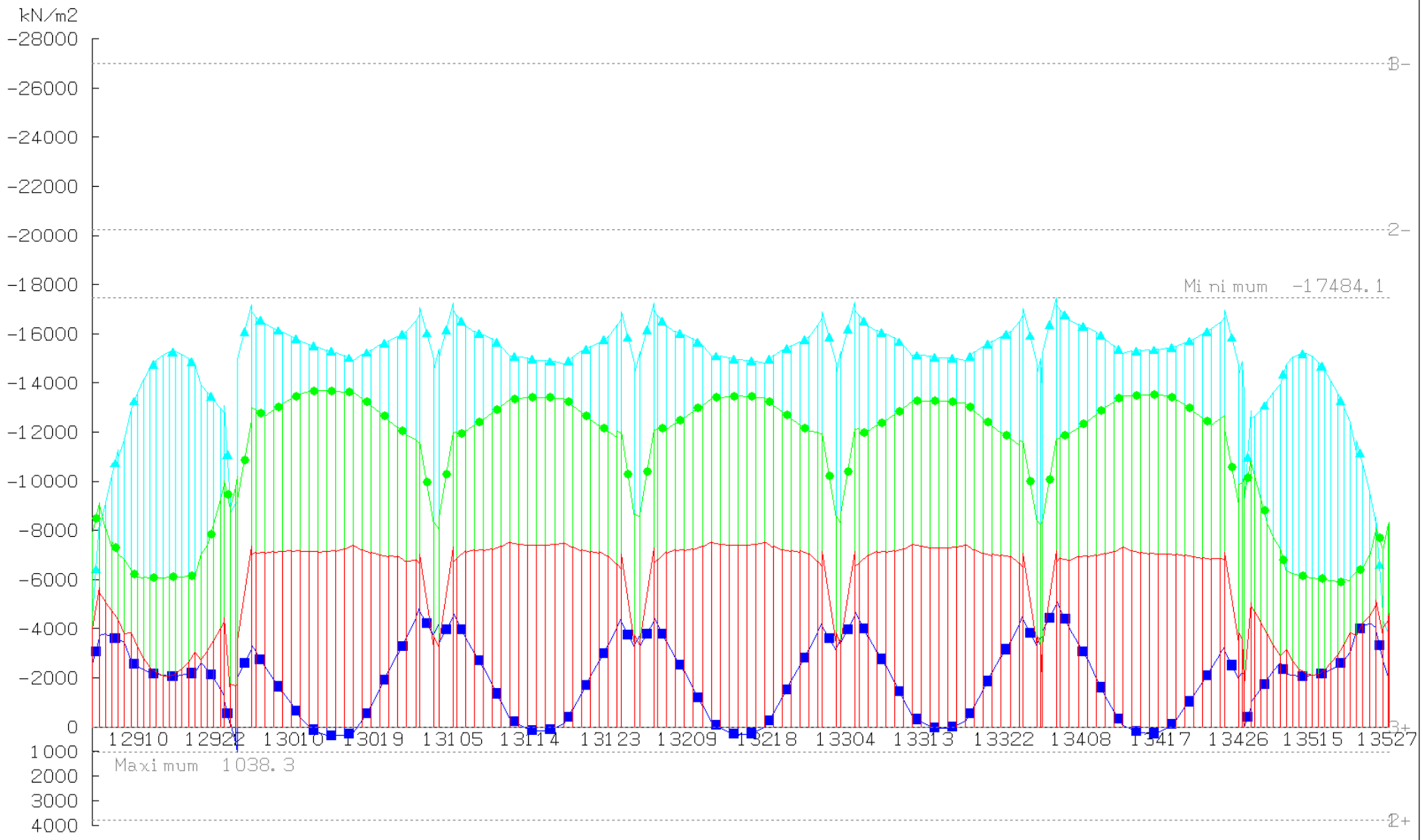

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Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird5, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G5

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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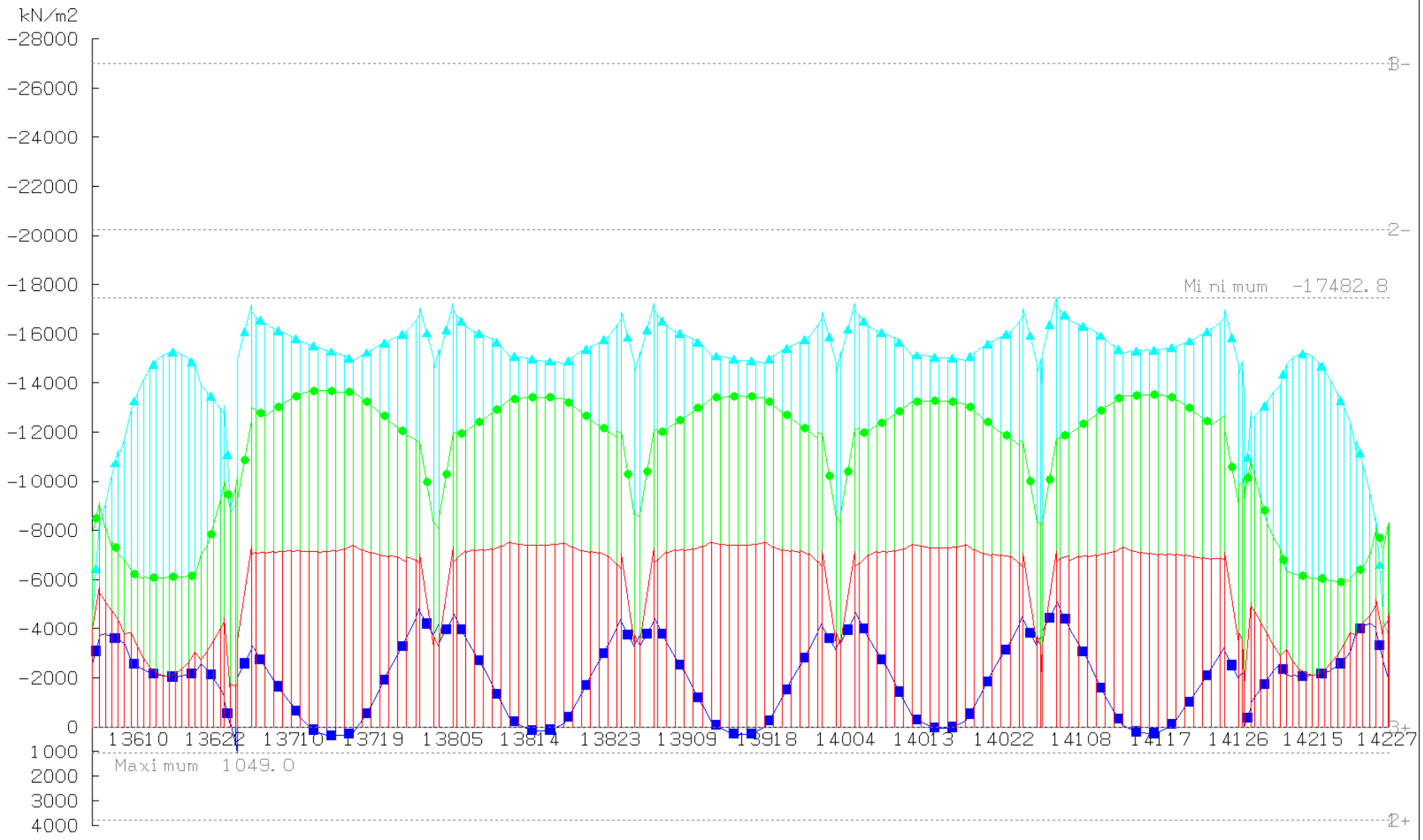

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Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird6, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G6

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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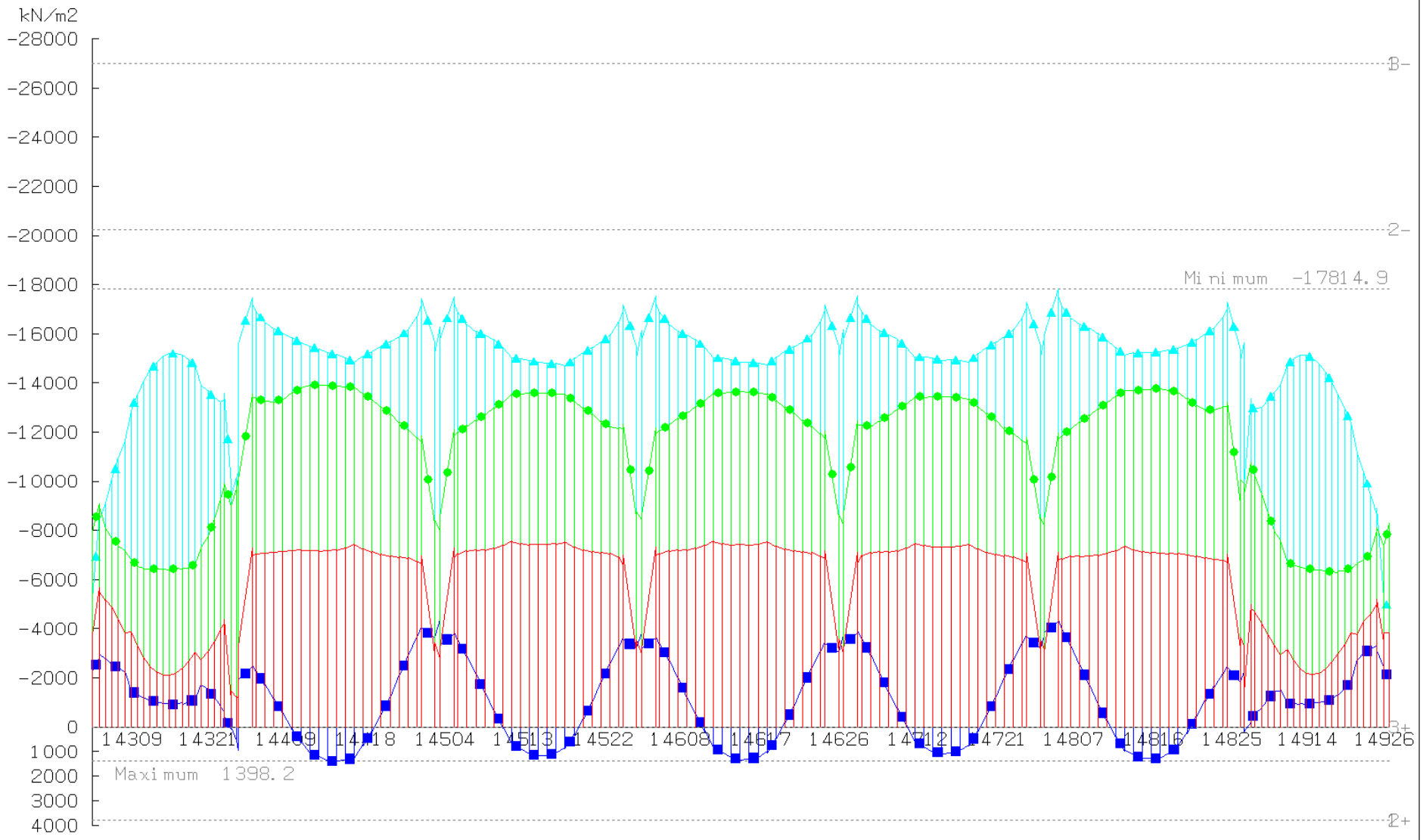

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Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird7, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G7

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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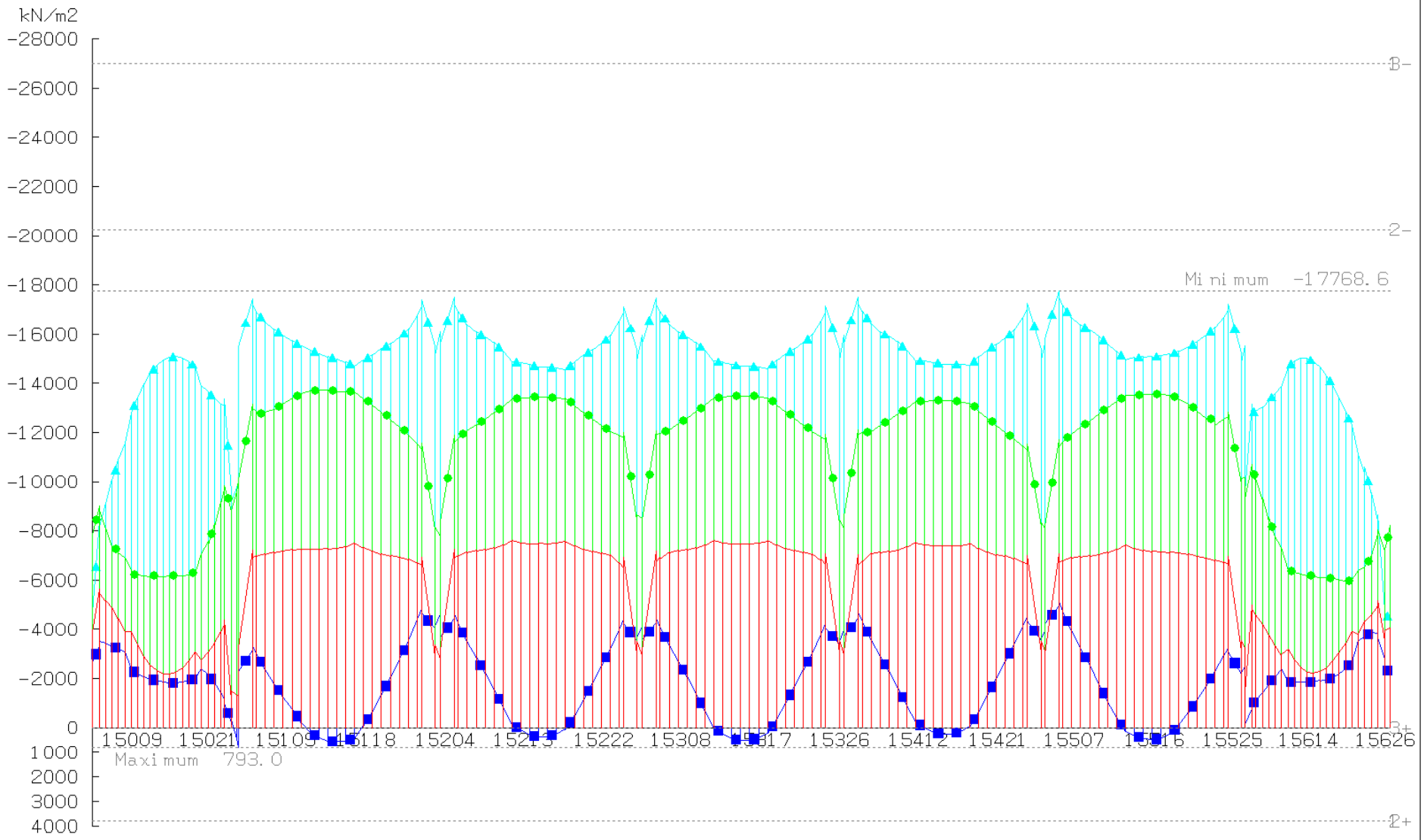

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Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird8, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G8

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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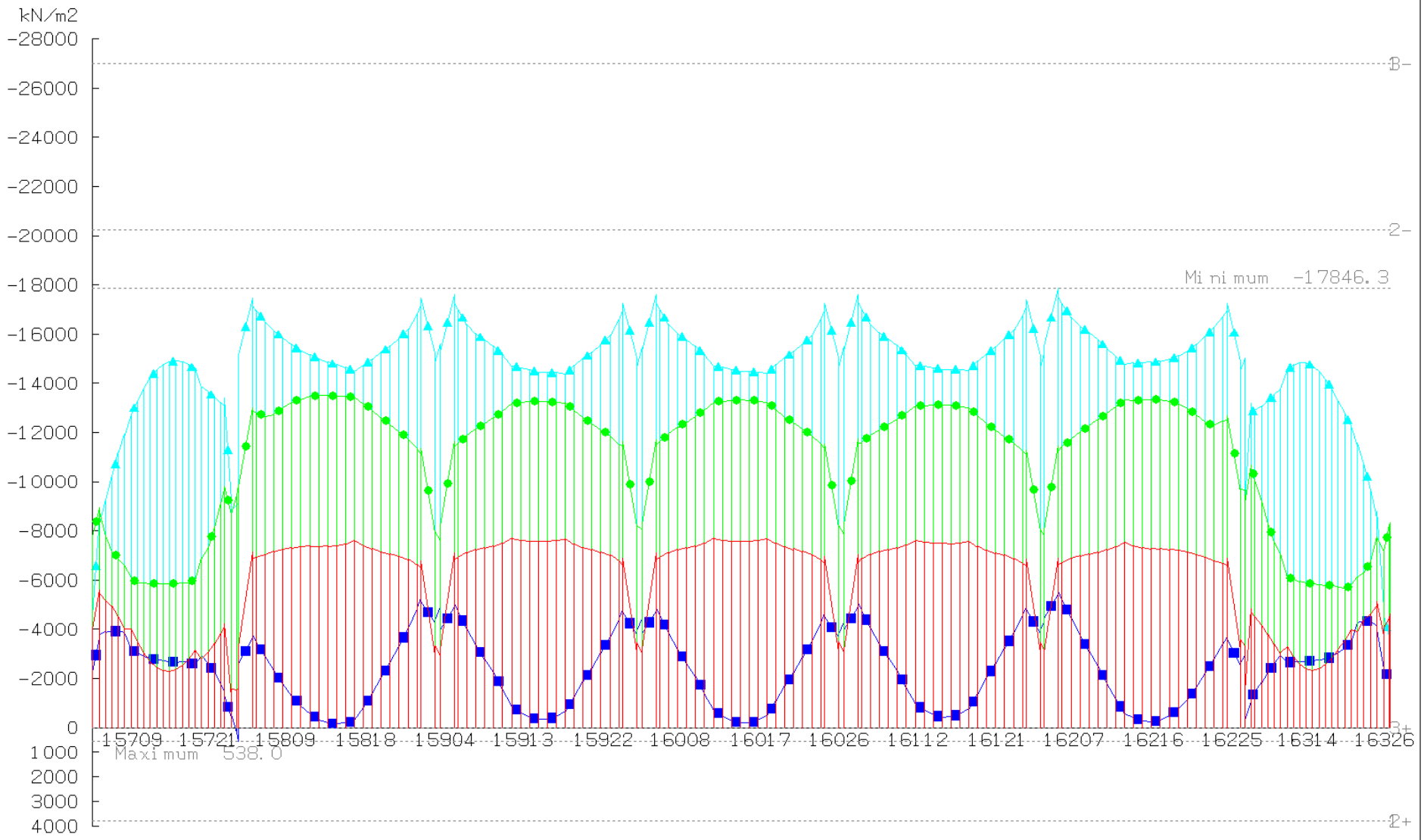

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Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird9, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G9

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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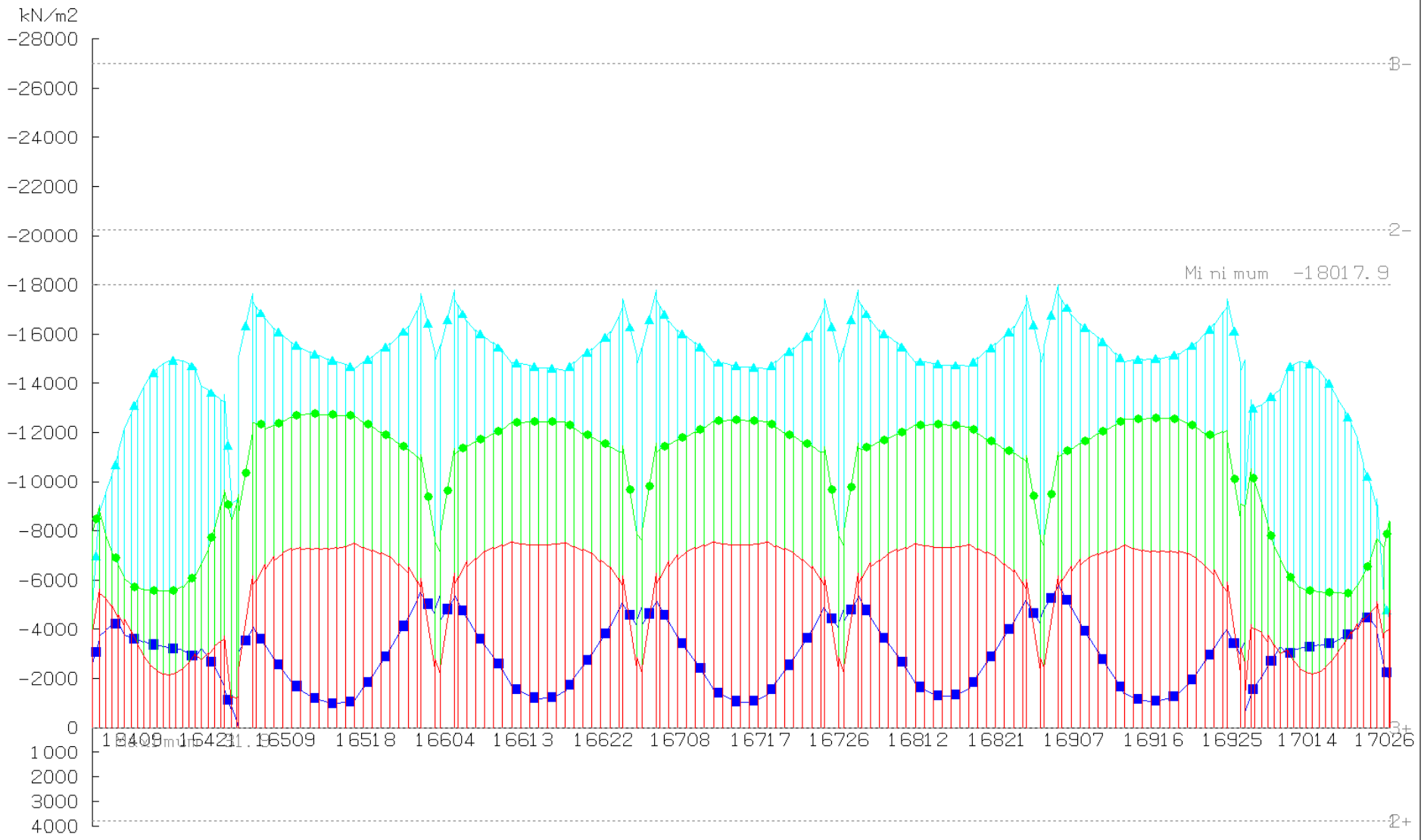

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Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird10, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G10

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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10:50

4.4.2.2. Напони затезања у бетону

Tension stresses in concrete

ЛЕГЕНДА /LEGEND:

Stress2:S2-T(max/min) - **максимални и минимални напони у горњем влакну** / Maximum and minimum values at top fiber

Stress2:S2-B(max/min) - **максимални и минимални напони у доњем влакну** / Maximum and minimum values at bottom fiber

Напони затезања у бетону/Concrete tensile stresses		
SLS-charac - σt ≤ 1.00*fctm		
fctm=	3.8	MPa

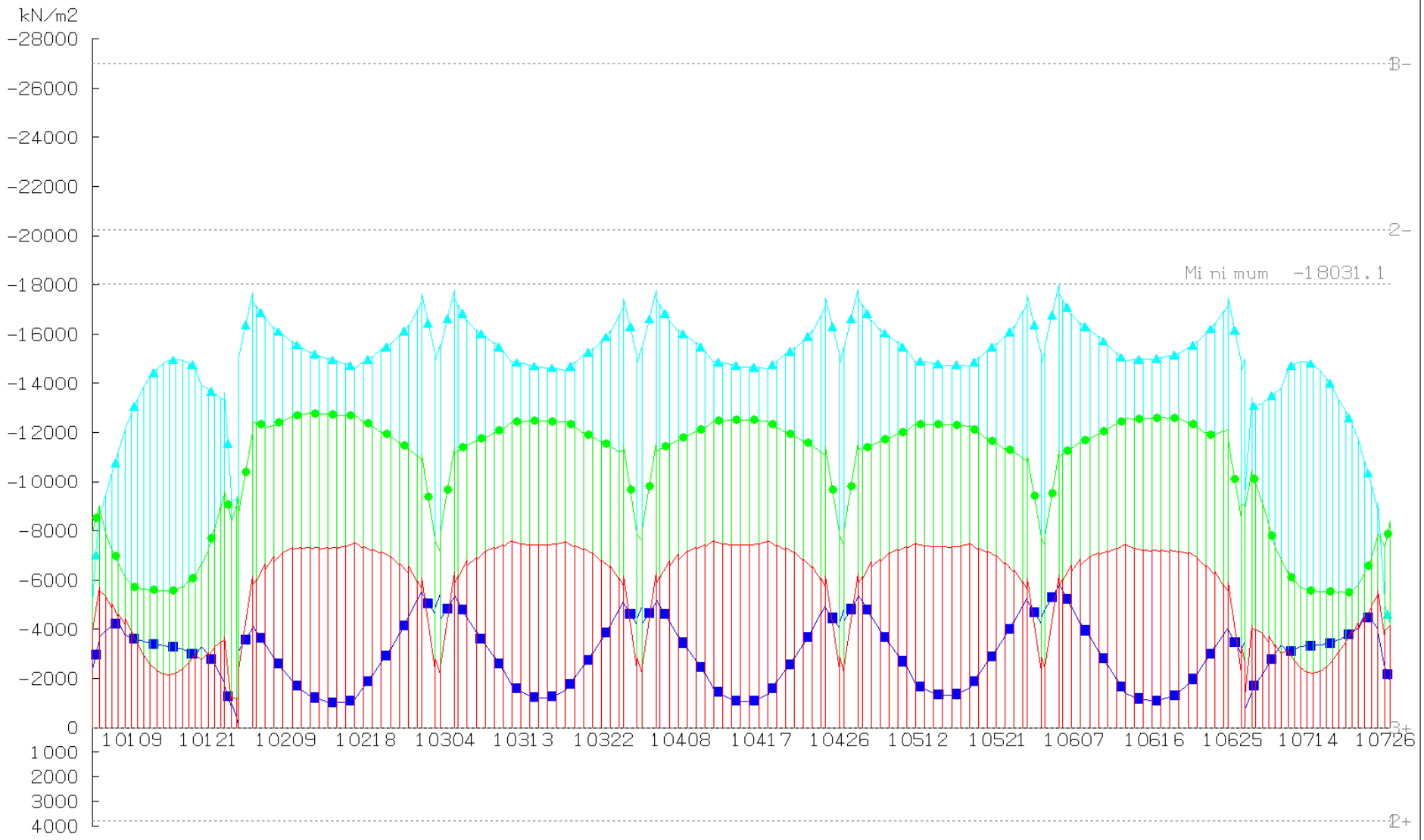
Сумирани приказ карактеристичних комбинација које улазе у анвелопу за проверу граничног стања употребљивости (SLS-characteristic)/

Characteristic combinations for SLS check**:**

rule	Load Case	Stages			SLS												
		Comb 01	Comb 02	Comb 03	Comb 04	Comb 05	Comb 06	Comb 07	Comb 08	Comb 09	Comb 10	Comb 11	Comb 12	Comb 13	Comb 14	Comb 15	Comb 16
		Construction stage			characteristic												
		Girders	STG1	Final	gr1					gr1		gr1				gr2	
Add	SUM-SW			1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Add	SUM-PT			1/1	1/1	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10
Add	SDL			1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Add	CS			1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Add	CSinf			1/1			1/1		1/1		1/1		1/1		1/1		1/1
And	Csinf				1												
And	LM1-TS				1	1	1	1	1	0.75	0.75	0.75	0.75			0.75	0.75
And	LM1-UDL				1	1	1	1	1	0.40	0.40	0.40	0.40			0.40	0.40
And	Pedestrian Load 3kN/m^2				1	1	1	1	1	0.40	0.40	0.40	0.40			0.40	0.40
And	Traction and breaking															1	1
And	FLM3																
And	Wind without traffic													1	1		
And	Wind with traffic							0.60	0.60			1	1				
And	Thermal				0.60	0.60	0.60			1	1					0.60	0.60

Rule –

правило додавања оптерећења, безусловно или само за повољно дејство. Скупљање и течење се узима у оба случаја, као безусловно и као повољно дејство. Безусловно је са rule-add, повољно је са rule-and. / rule for adding loads into combinations, unconditionally ot only favoruable case. Creep and shrinkage is taken double, one combination is with unconditional case and other only for favourable effect.



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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird1, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G1

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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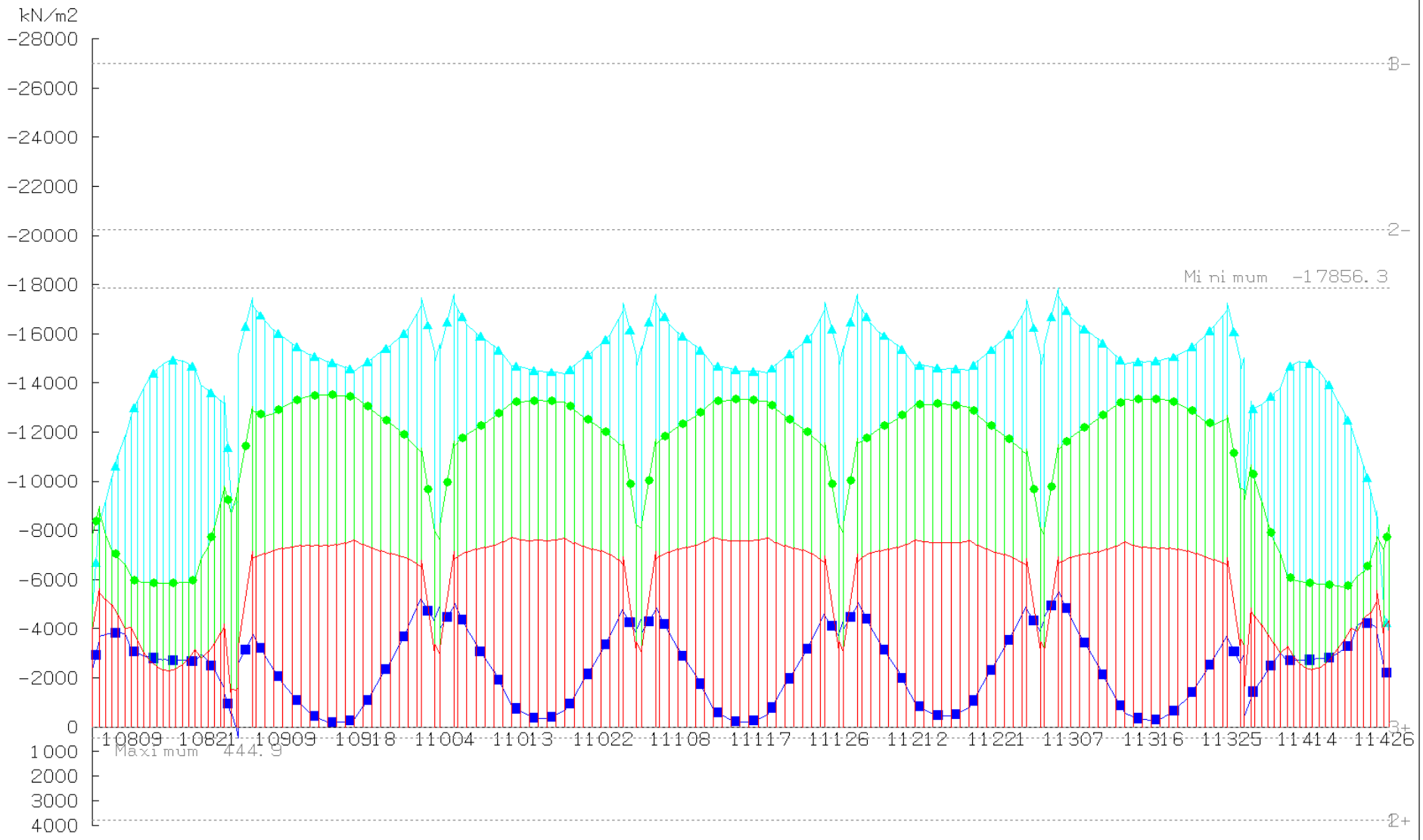
10:50



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Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird2, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G2

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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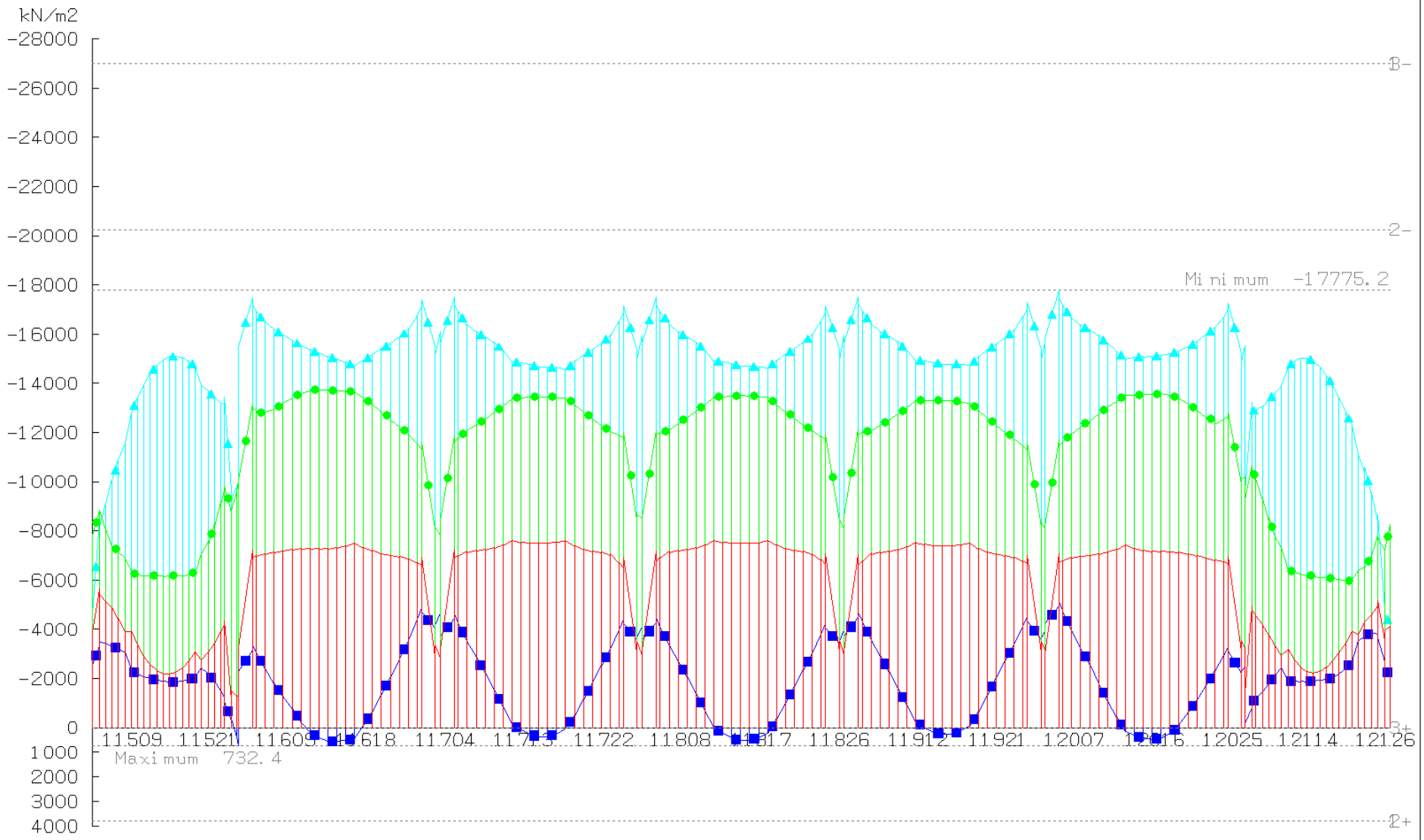

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Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird3, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G3

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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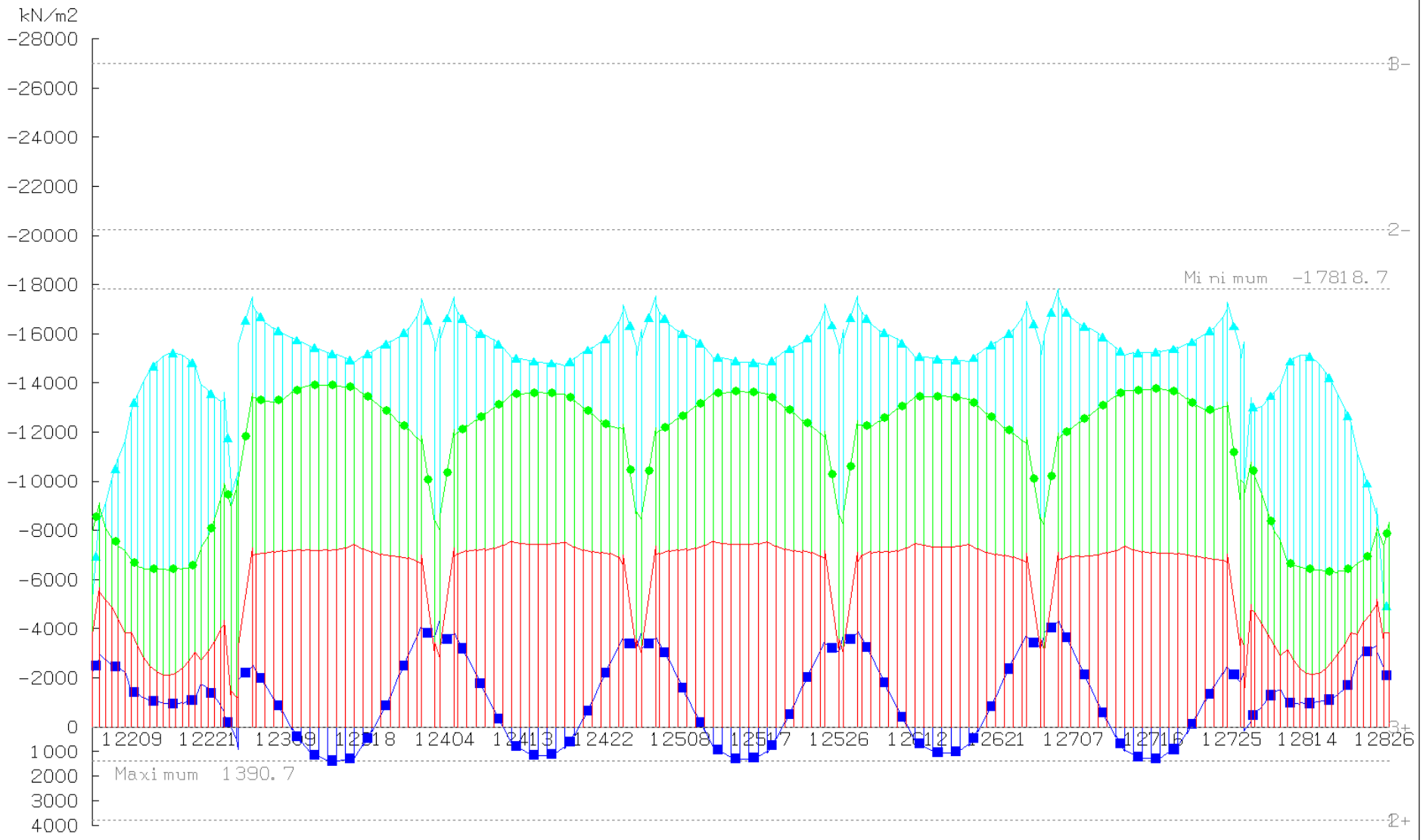

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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird4, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G4

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
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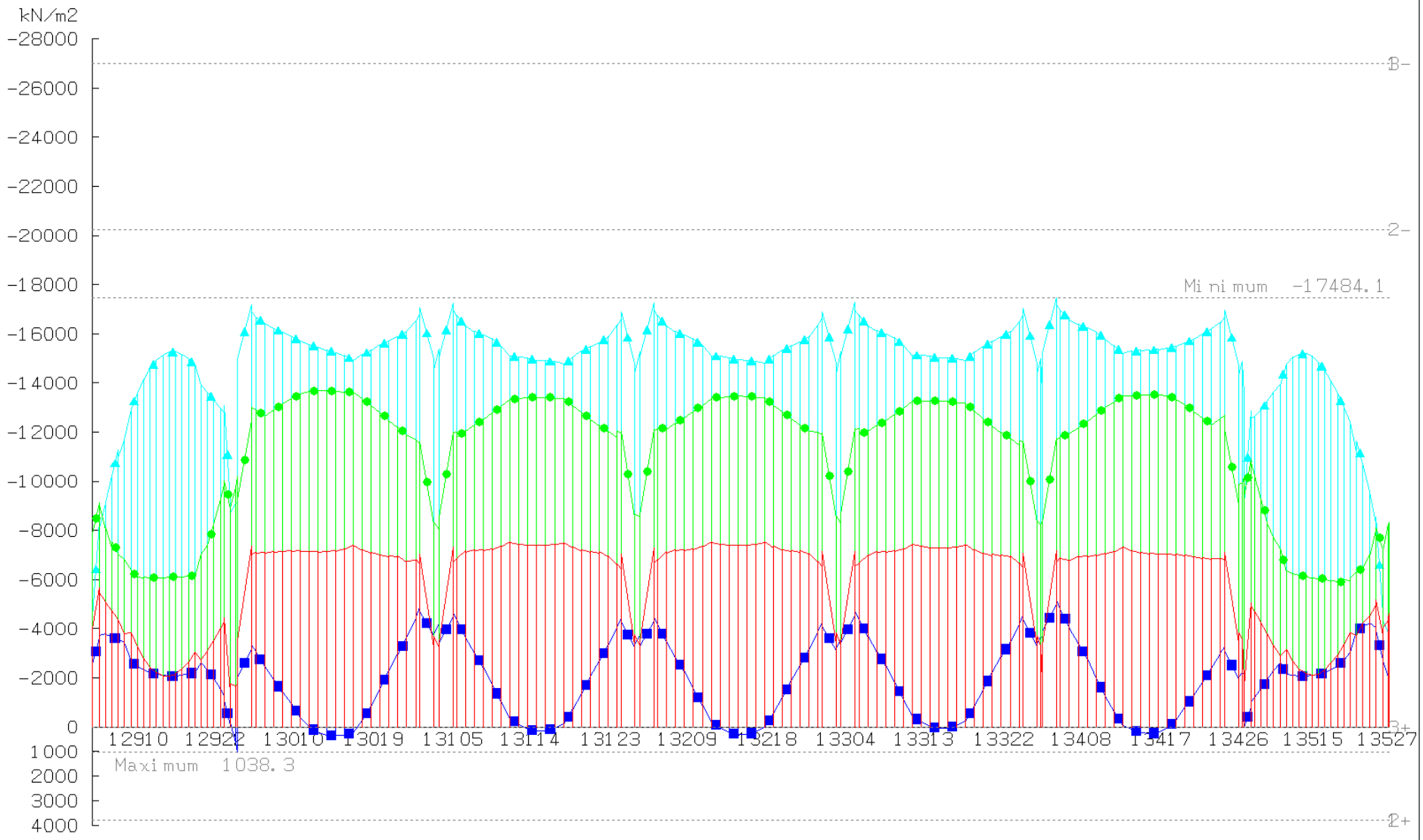

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird5, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G5

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
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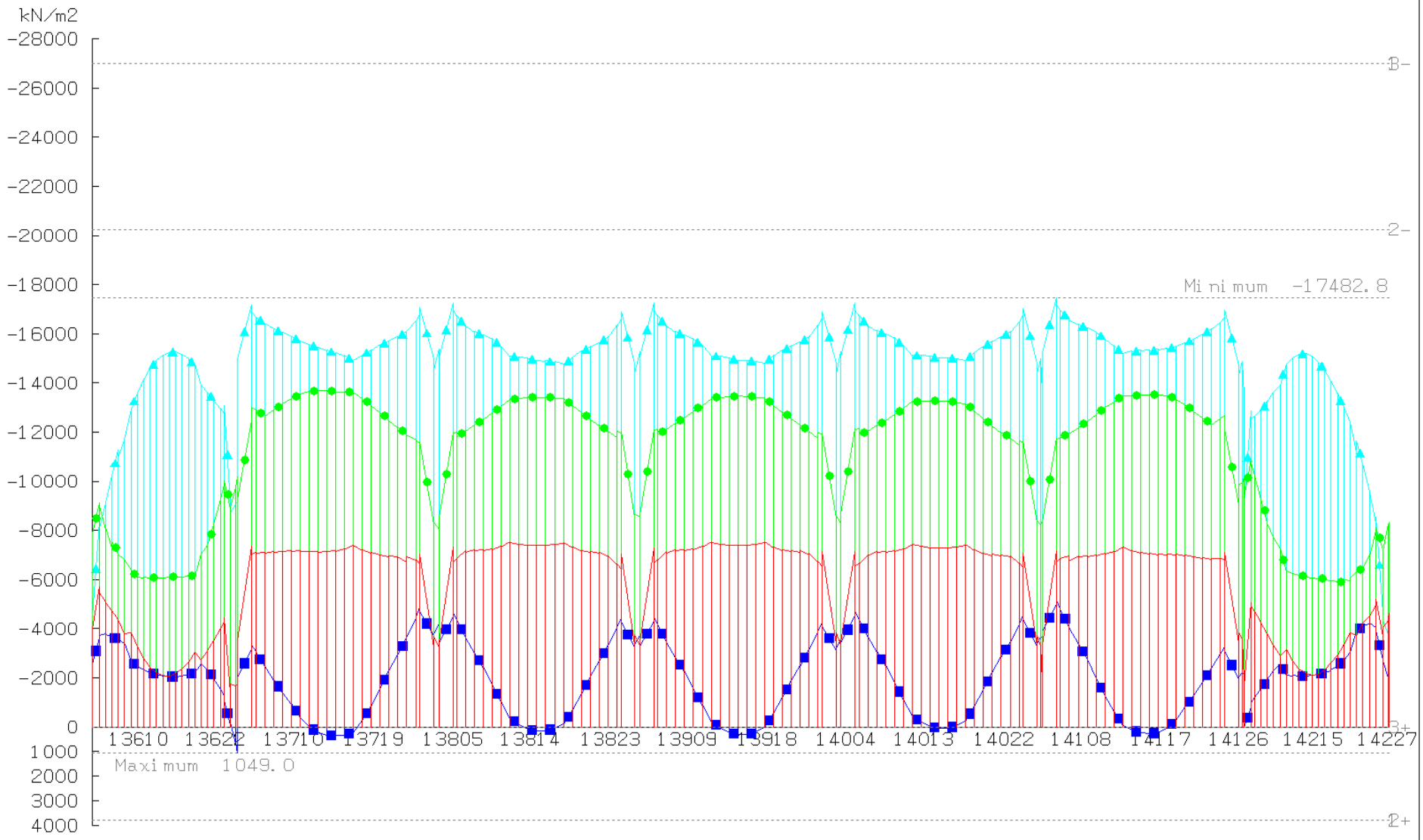

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Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird6, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G6

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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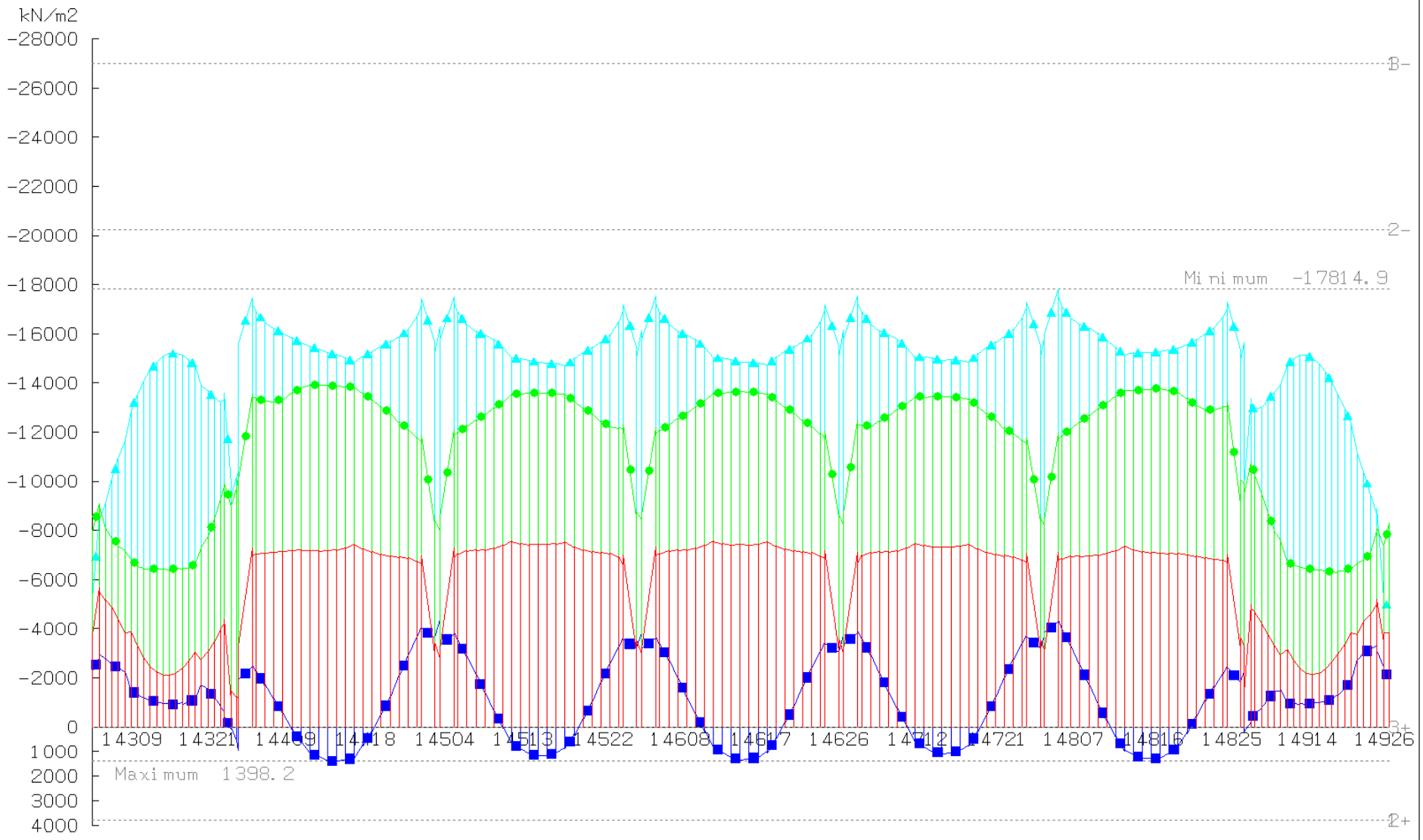

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Author: DB Inzenjering , Beograd

Project: 95+739

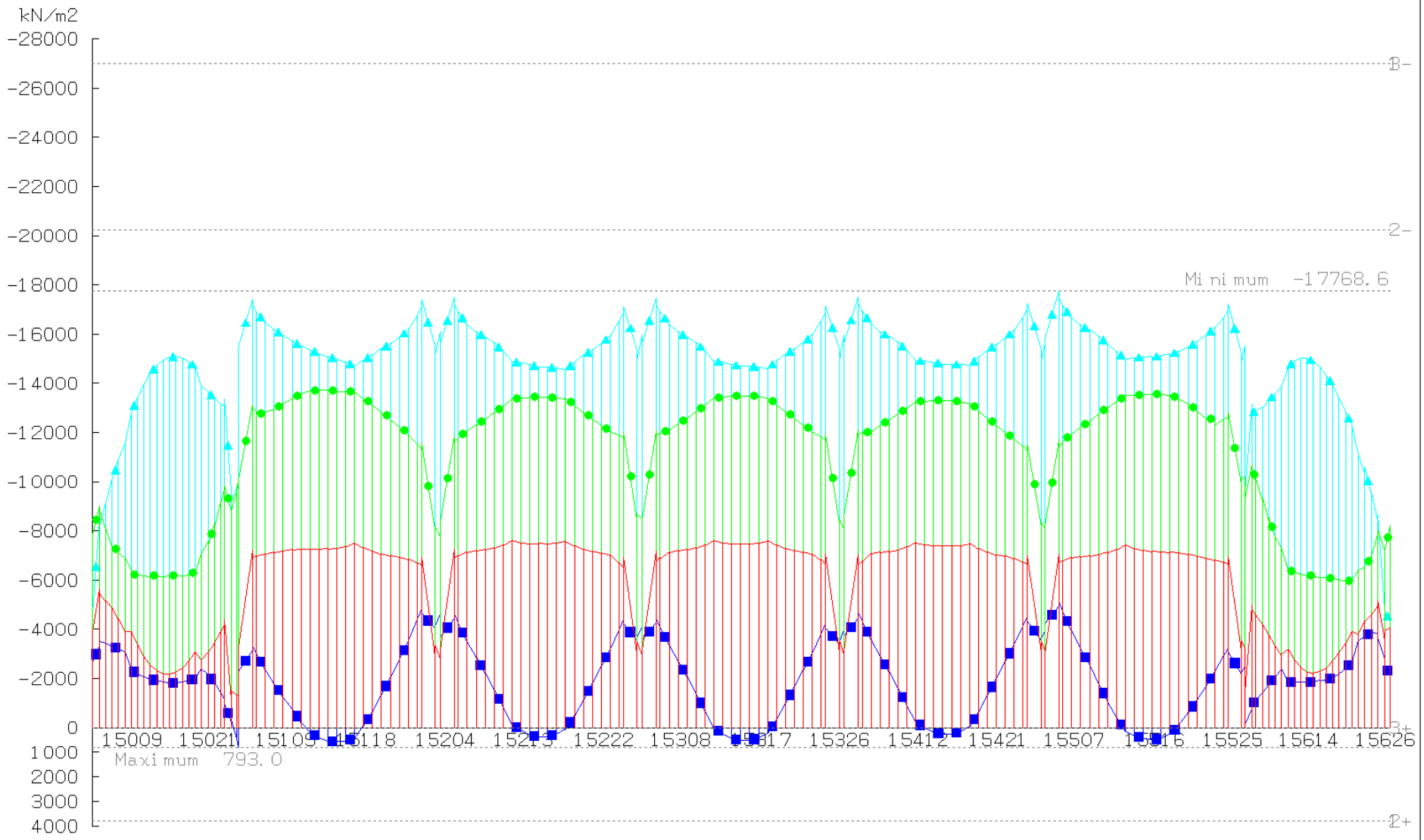
RmSet: 01-Gird7, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G7

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

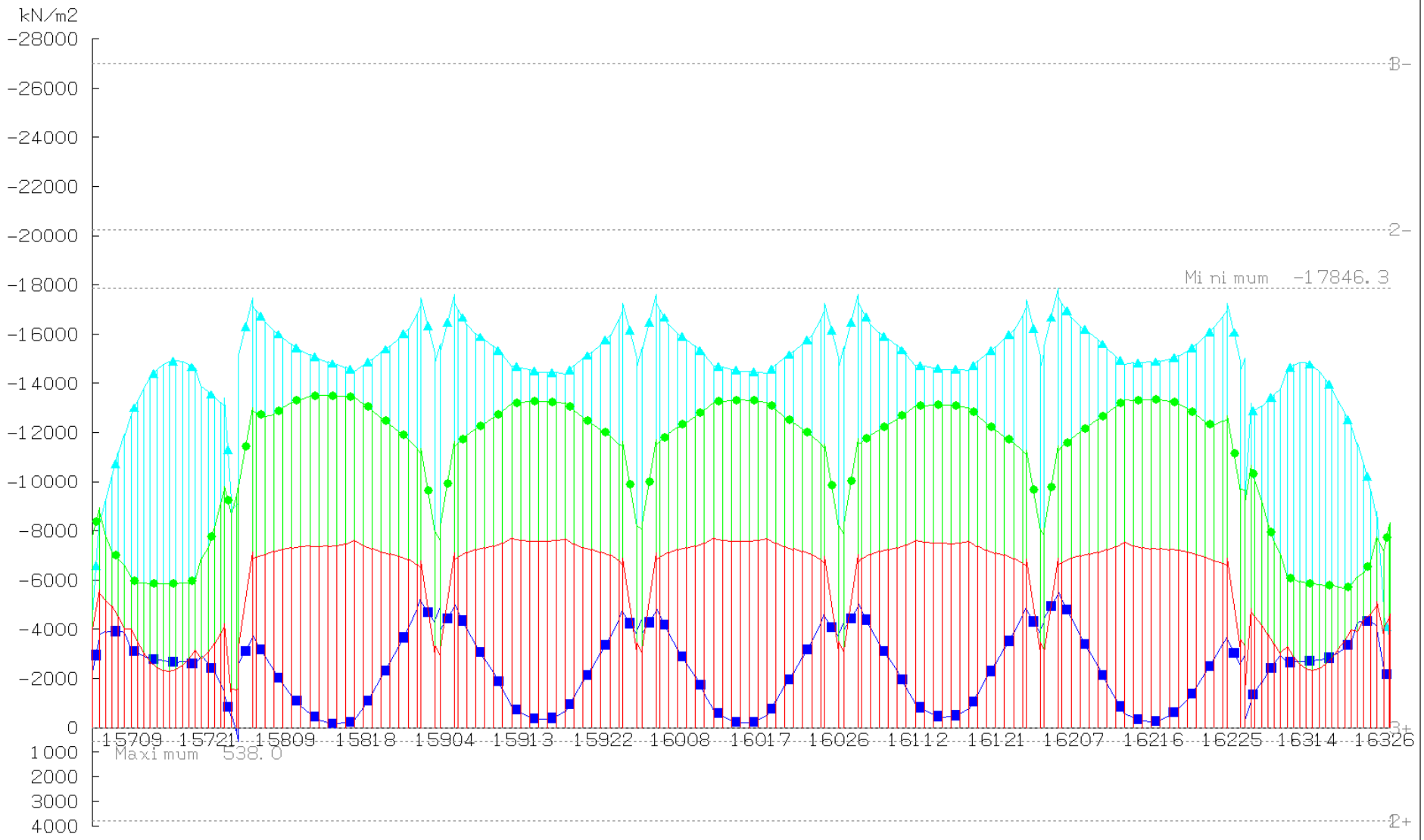
RmSet: 01-Gird8, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G8

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

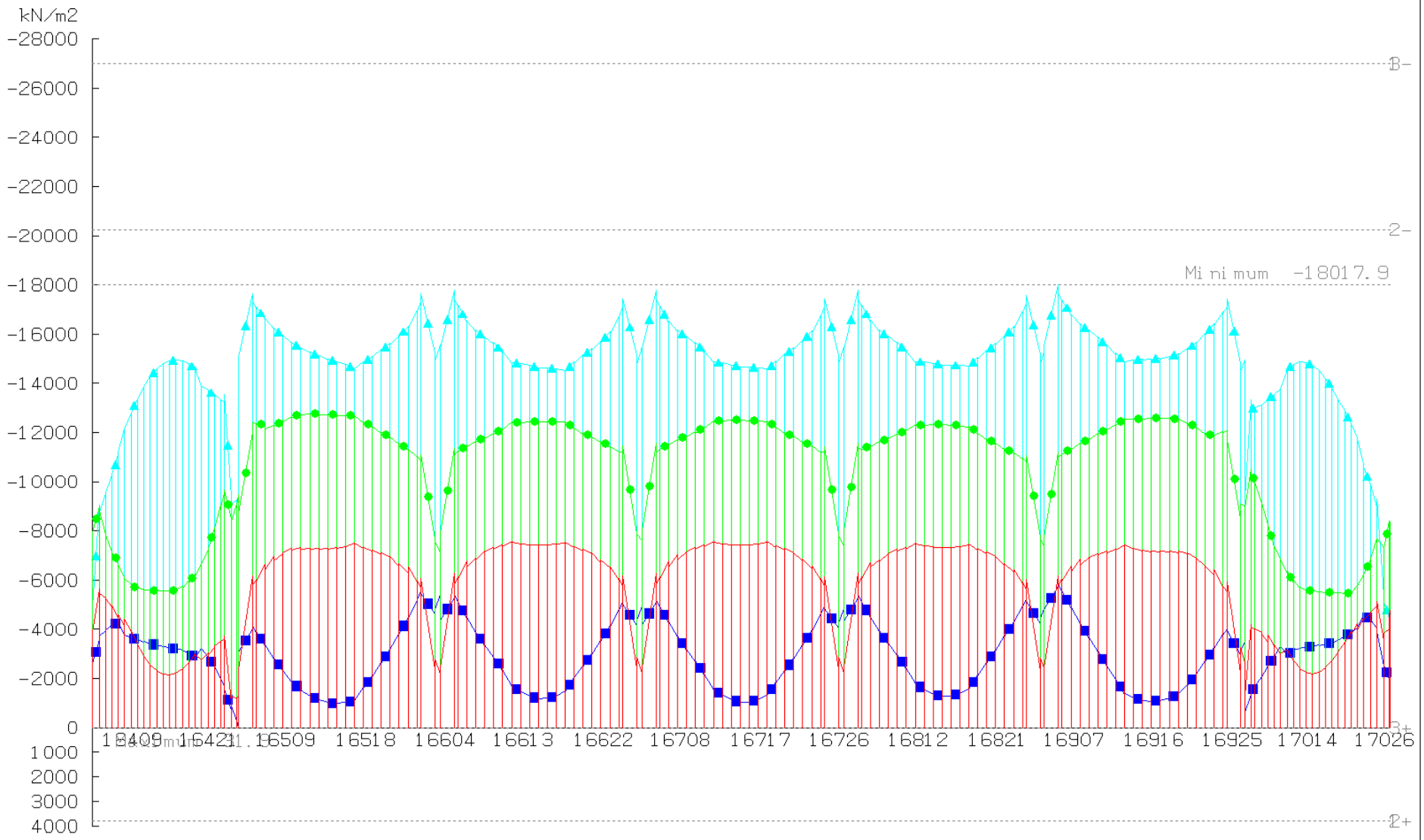
RmSet: 01-Gird9, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G9

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 01-Gird10, Stage: A1-SLS-charac

(DefaultSchedule)/A1-SLS-charac-G10

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50

4.4.2.3. Контрола декомпресије

Decompression check

ЛЕГЕНДА /LEGEND:

Stress2:S2-T(max/min) - **максимални и минимални напони у горњем влакну** / Maximum and minimum values at top fiber

Stress2:S2-B(max/min) - **максимални и минимални напони у доњем влакну** / Maximum and minimum values at bottom fiber

Контрола декомпресије/Decompression check
SLS-frequent - σc ≤ 0
ако је заштитни слој бетона до тежишта каблова мањи од 100 mm/if concrete cover is less then 100mm

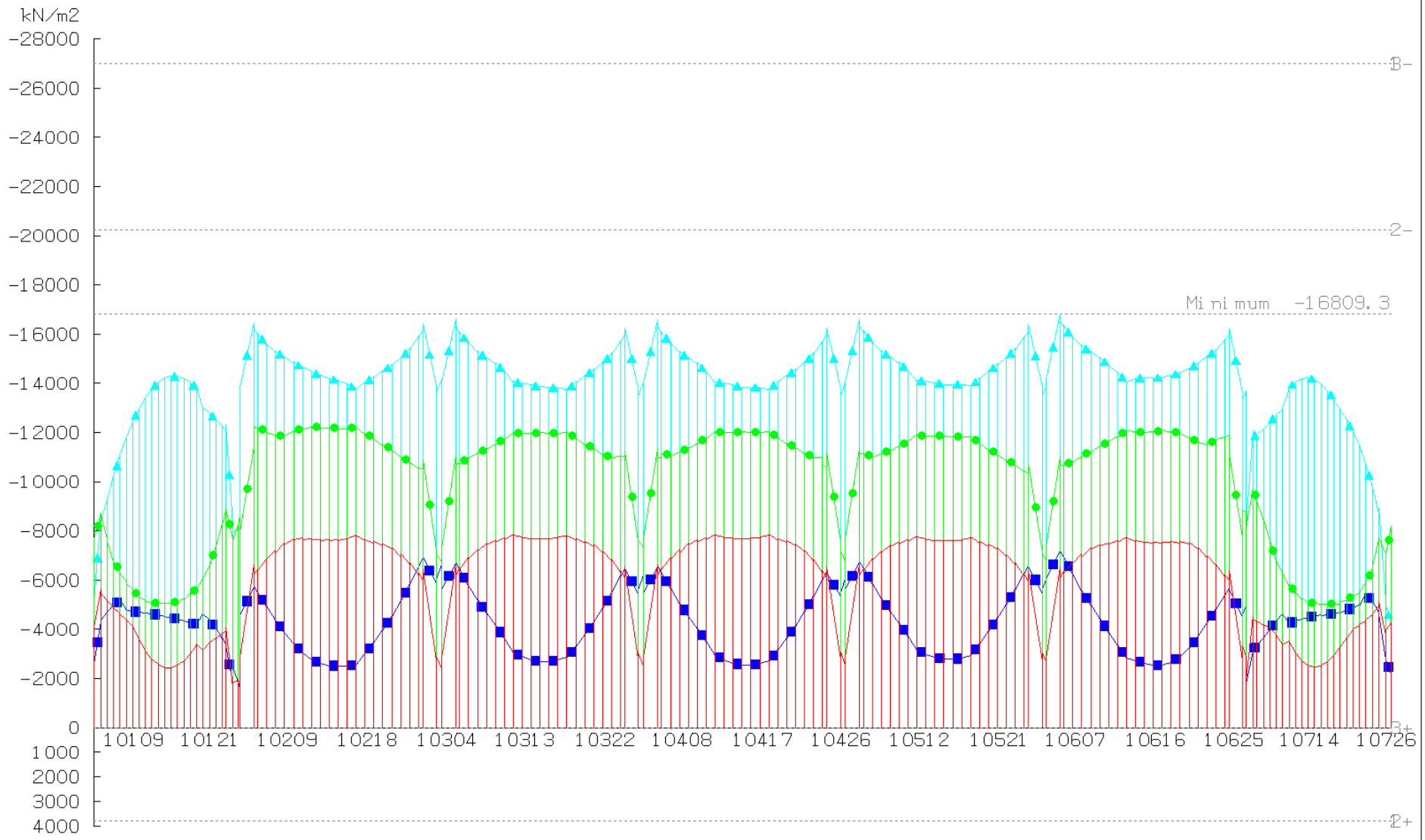
Сумирани приказ честих комбинација које улазе у анвелопу за проверу граничног стања употребљивости (SLS-frequent)/

Frequent combinations for SLS check:

rule	Load Case	SLS					
		Comb 17	Comb 18	Comb 19	Comb 20	Comb 21	Comb 22
		frequent					
Add	SUM-SW	1/1	1/1	1/1	1/1	1/1	1/1
Add	SUM-PT	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10
Add	SDL	1/1	1/1	1/1	1/1	1/1	1/1
Add	CS	1/1	1/1	1/1	1/1	1/1	1/1
Add	CSinf		1/1		1/1		1/1
And	Csinf						
And	LM1-TS	0.75	0.75				
And	LM1-UDL	0.40	0.40				
And	Pedestrian Load 3kN/m^2						
And	Traction and breaking						
And	FLM3						
And	Wind without traffic					0.20	0.20
And	Wind with traffic						
And	Thermal	0.50	0.50	0.60	0.60		

Rule –

правило додавања оптерећења, безусловно или само за повољно дејство. Скупљање и течење се узима у оба случаја, као безусловно и као повољно дејство. Безусловно је са rule-add, повољно је са rule-and. / rule for adding loads into combinations, unconditionally ot only favoruable case. Creep and shrinkage is taken double, one combination is with unconditional case and other only for favourable effect.



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

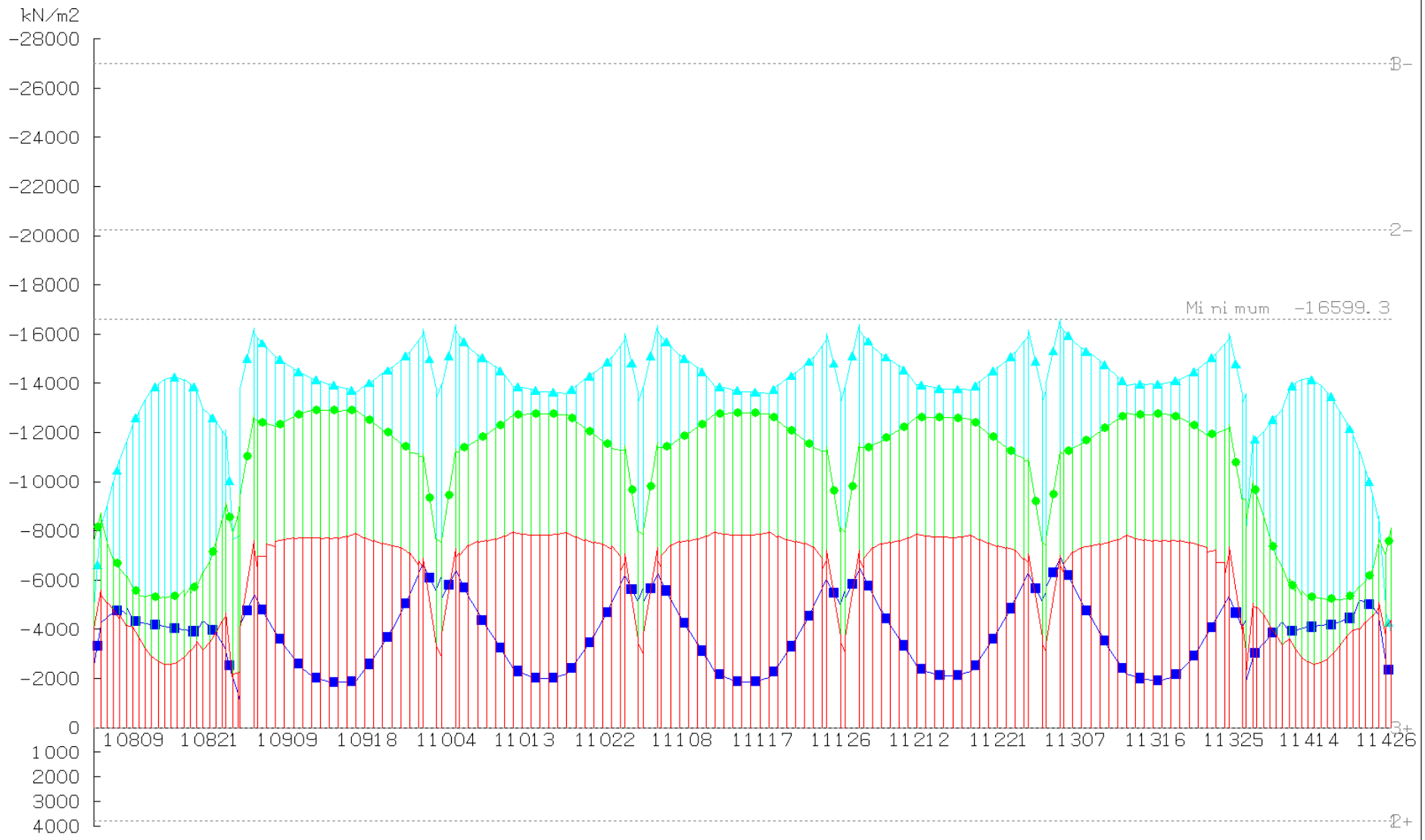
RmSet: 02-Gird1, Stage: A2-SLS-freq

(DefaultSchedule)/A2-decomp-G1

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

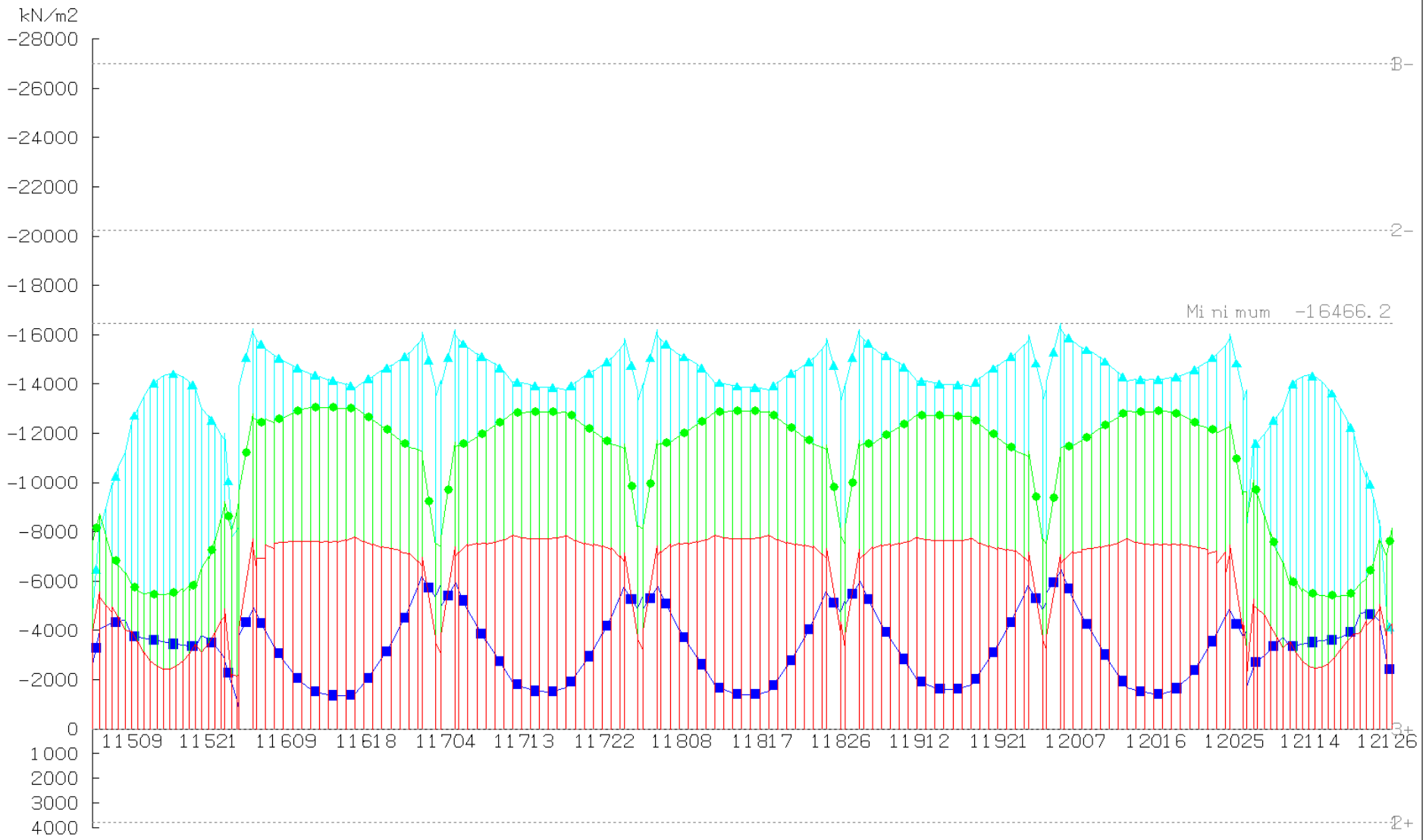
RmSet: 02-Gird2, Stage: A2-SLS-freq

(DefaultSchedule)/A2-decomp-G2

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

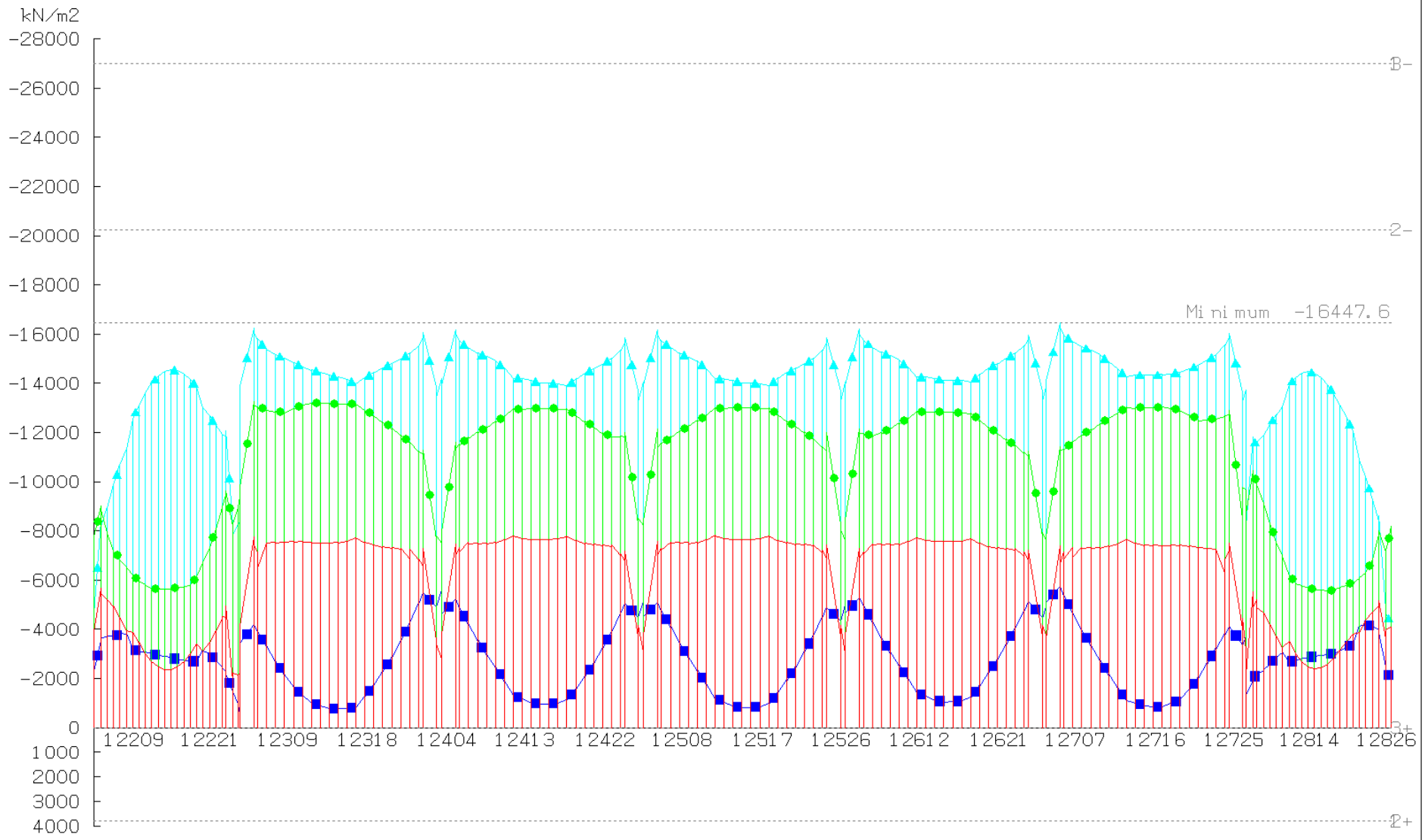
RmSet: 02-Gird3, Stage: A2-SLS-freq

(DefaultSchedule)/A2-decomp-G3

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

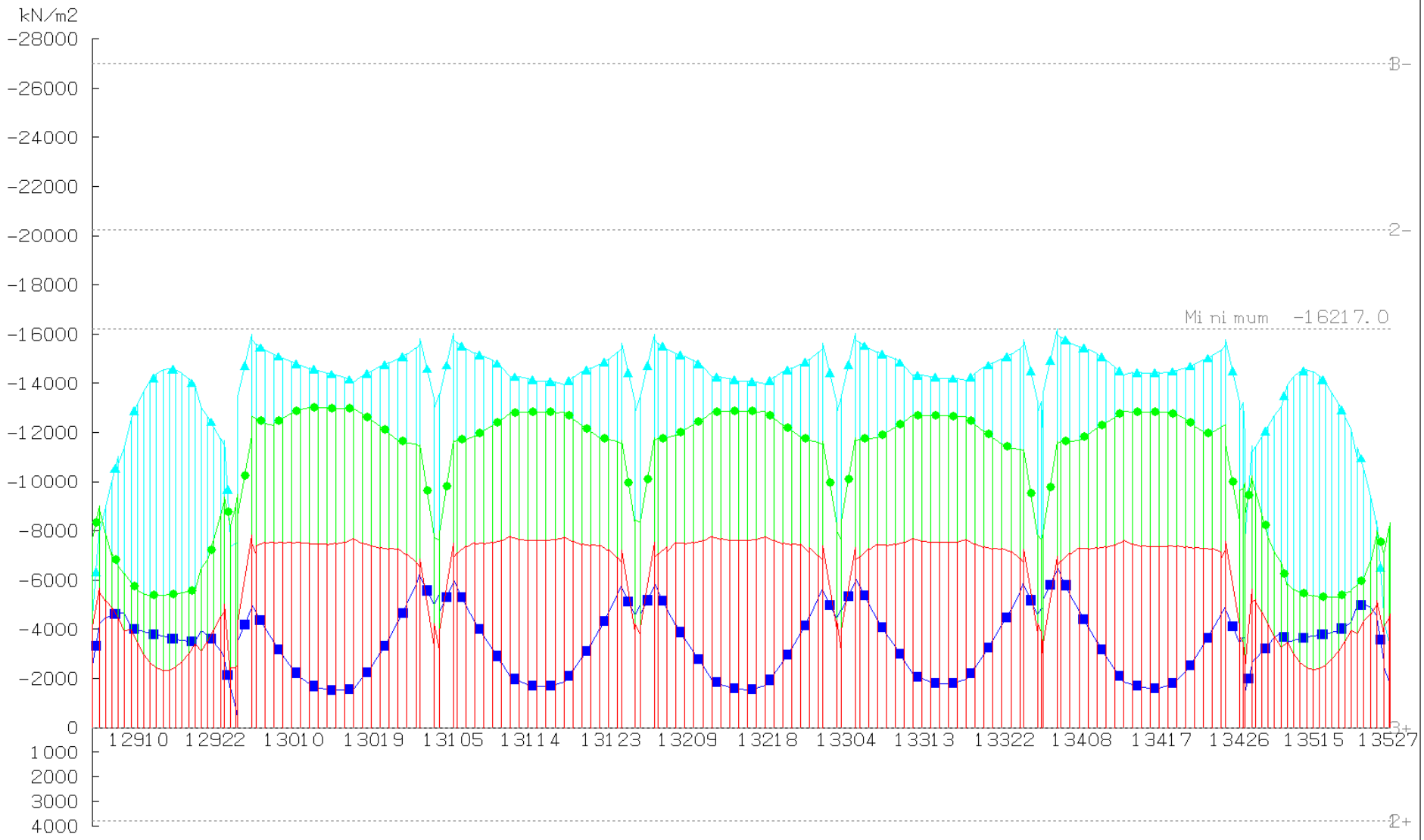
RmSet: 02-Gird4, Stage: A2-SLS-freq

(DefaultSchedule)/A2-decomp-G4

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

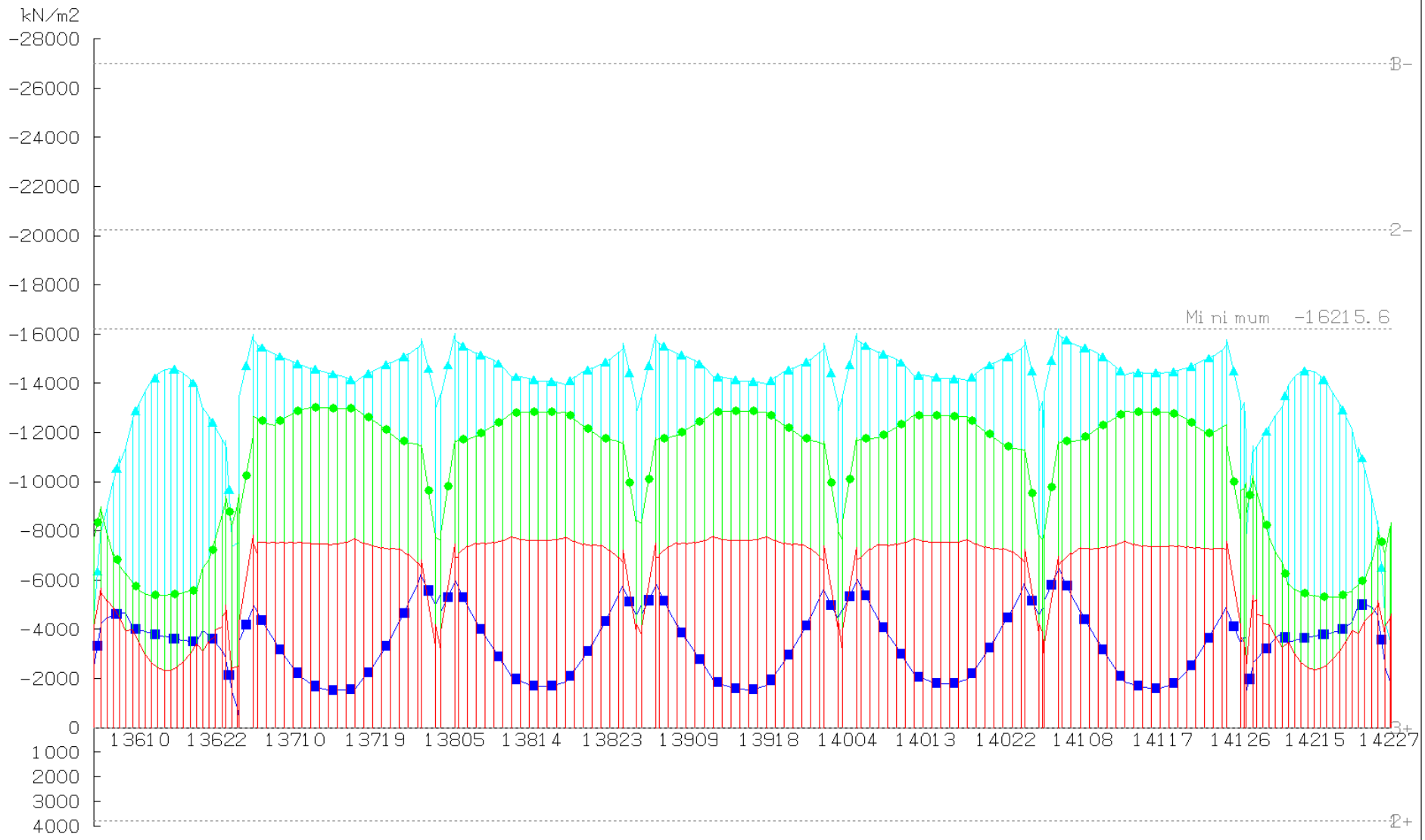
RmSet: 02-Gird5, Stage: A2-SLS-freq

(DefaultSchedule)/A2-decomp-G5

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

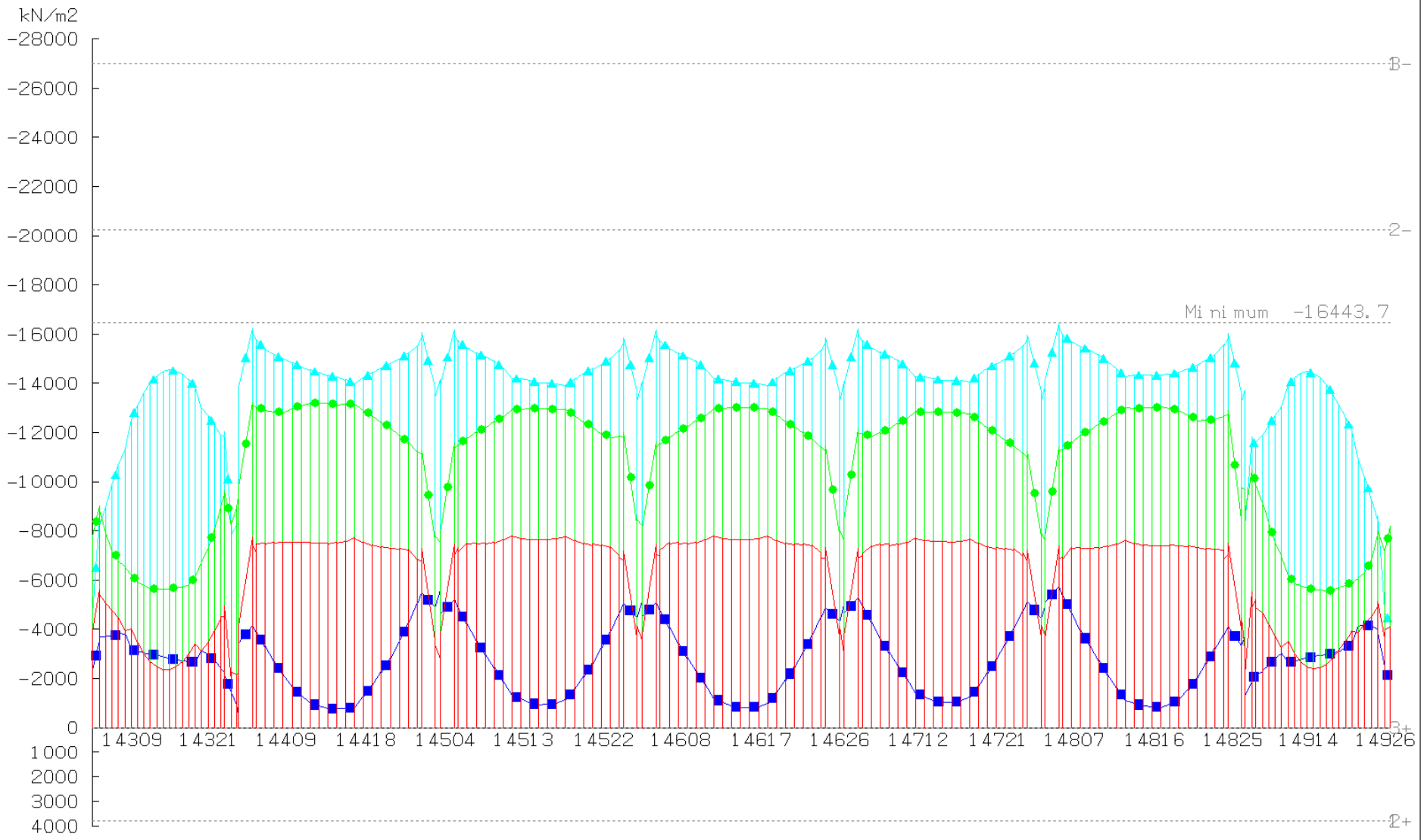
RmSet: 02-Gird6, Stage: A2-SLS-freq

(DefaultSchedule)/A2-decomp-G6

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

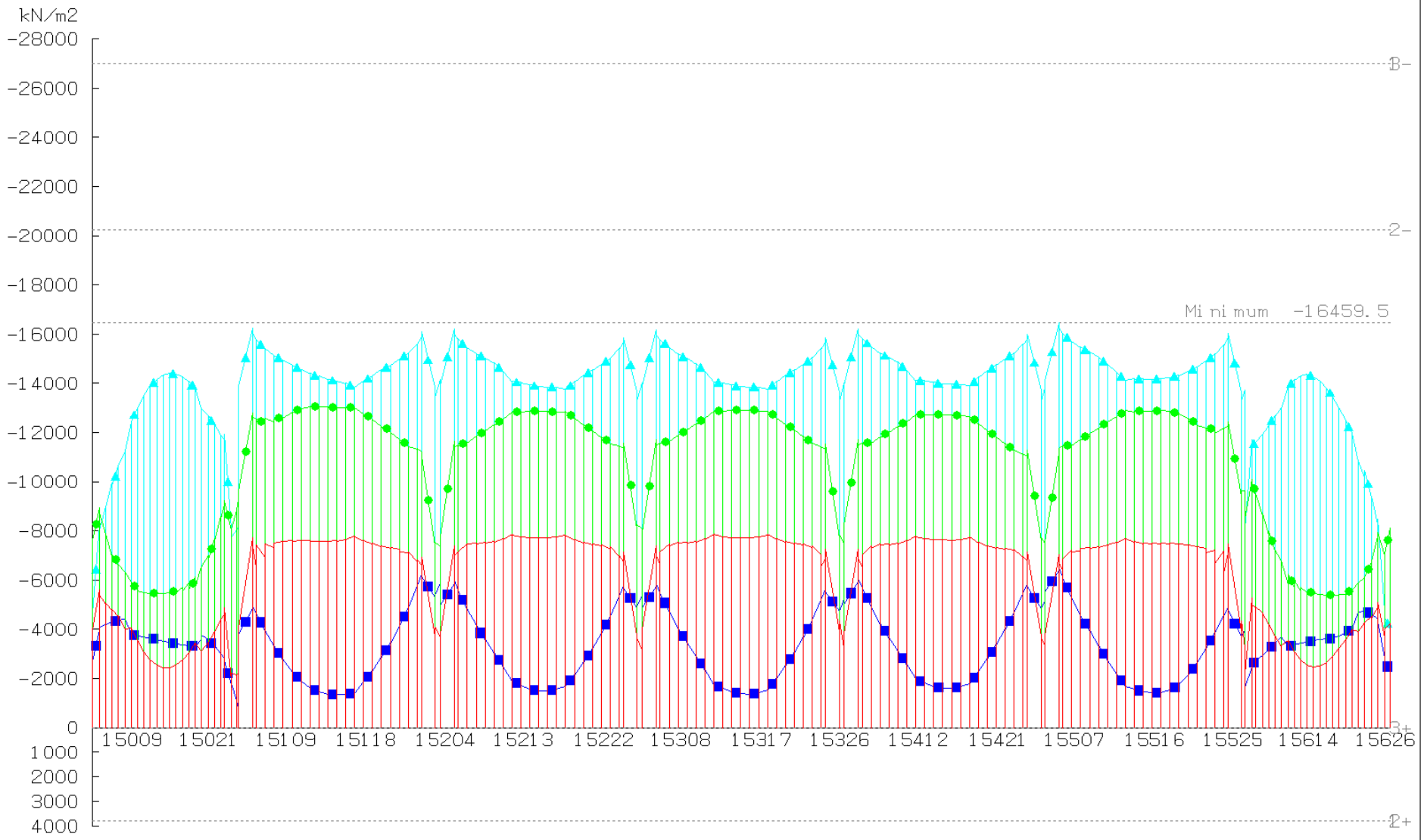
RmSet: 02-Gird7, Stage: A2-SLS-freq

(DefaultSchedule)/A2-decomp-G7

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

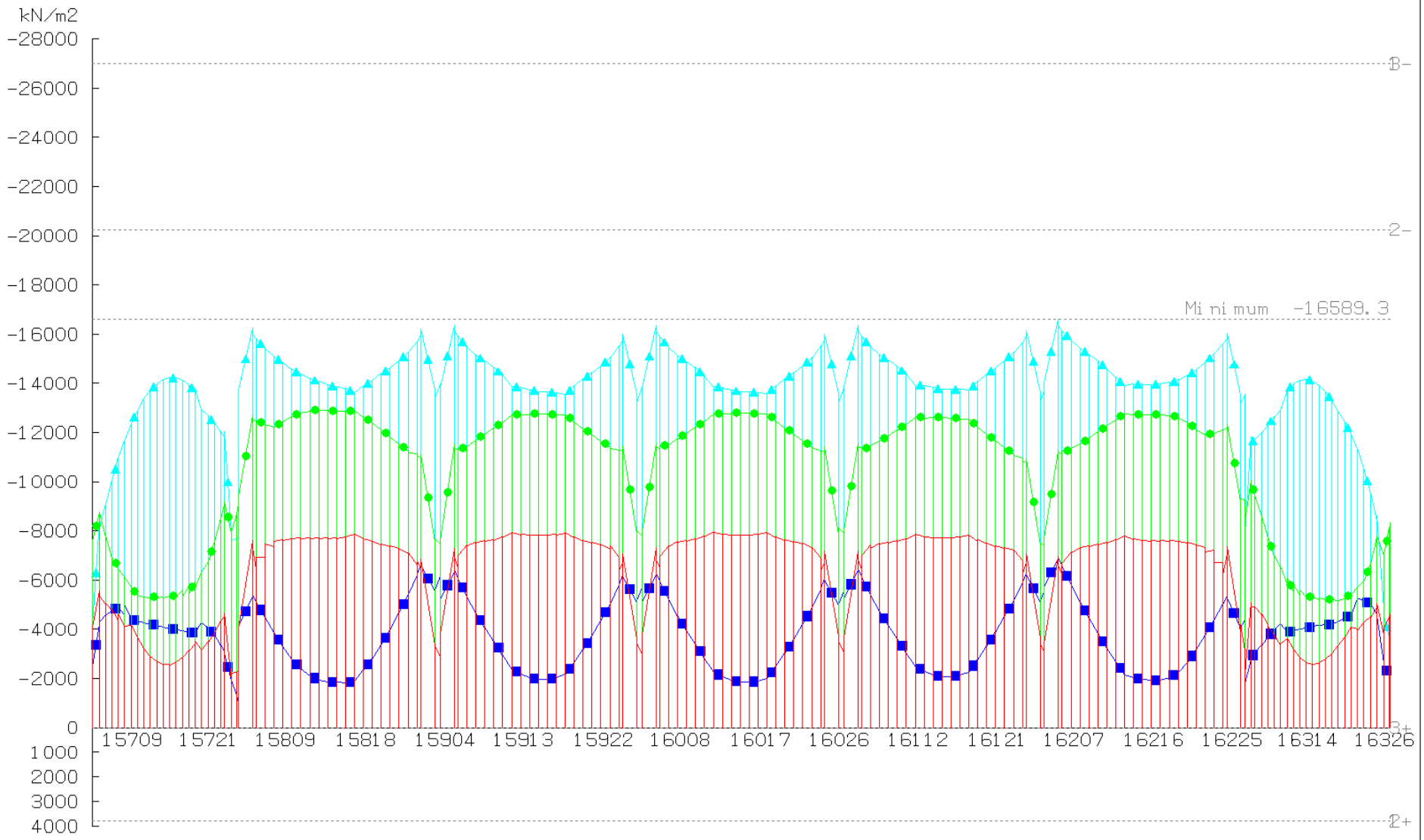
RmSet: 02-Gird8, Stage: A2-SLS-freq

(DefaultSchedule)/A2-decomp-G8

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

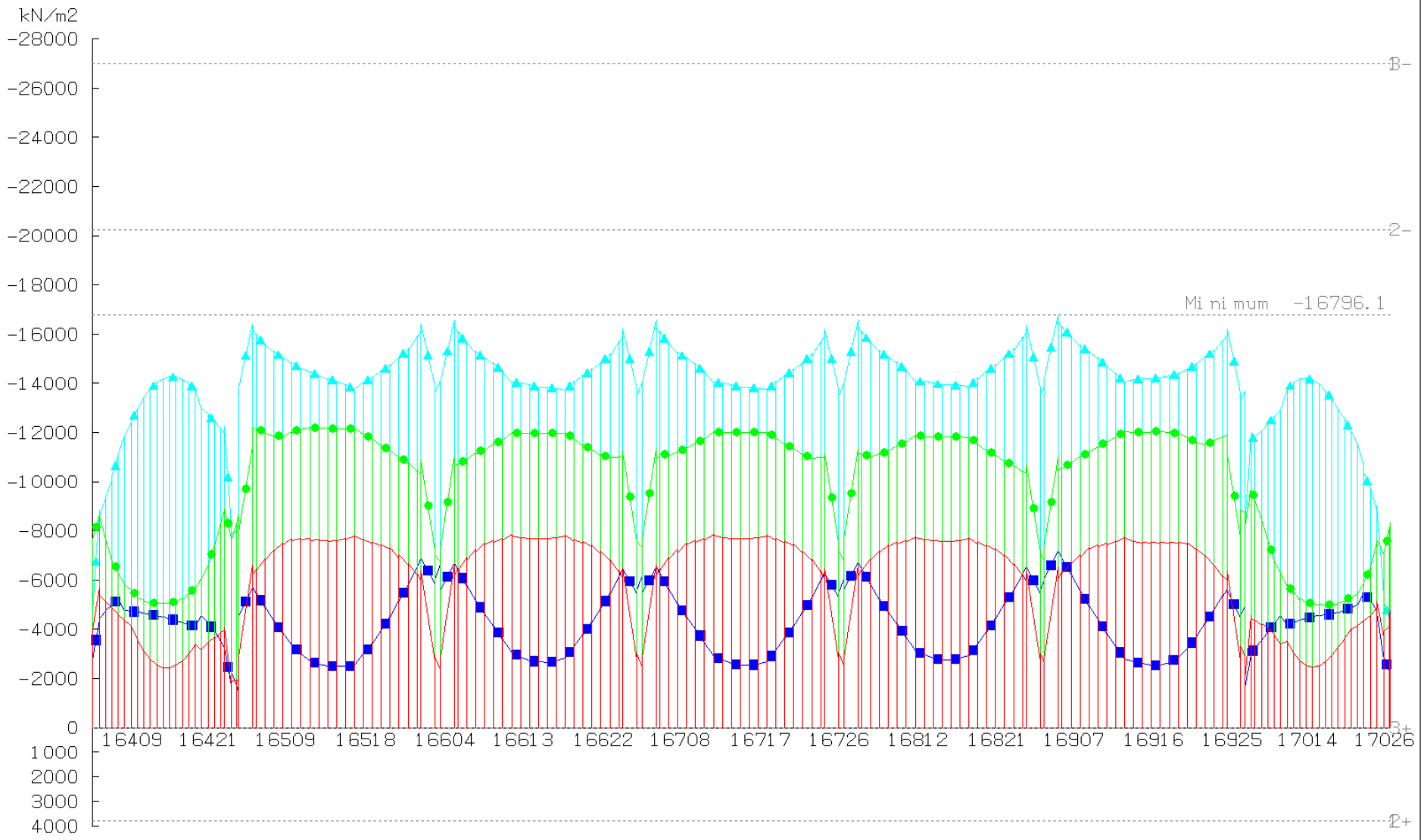
RmSet: 02-Gird9, Stage: A2-SLS-freq

(DefaultSchedule)/A2-decomp-G9

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 02-Gird10, Stage: A2-SLS-freq

(DefaultSchedule)/A2-decomp-G10

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50

4.4.2.4. Контрола линеарног течења

Creep calculation

ЛЕГЕНДА /LEGEND:

Stress2:S2-T(max/min) - **максимални и минимални напони у горњем влакну** / Maximum and minimum values at top fiber

Stress2:S2-B(max/min) - **максимални и минимални напони у доњем влакну** / Maximum and minimum values at bottom fiber

Контрола линеарног течења/Linear creep stress						
SLS-quasi-perm - σc ≥ - 0.45*fck						
fck=	45	MPa	→	0.45*fck	20.25	MPa

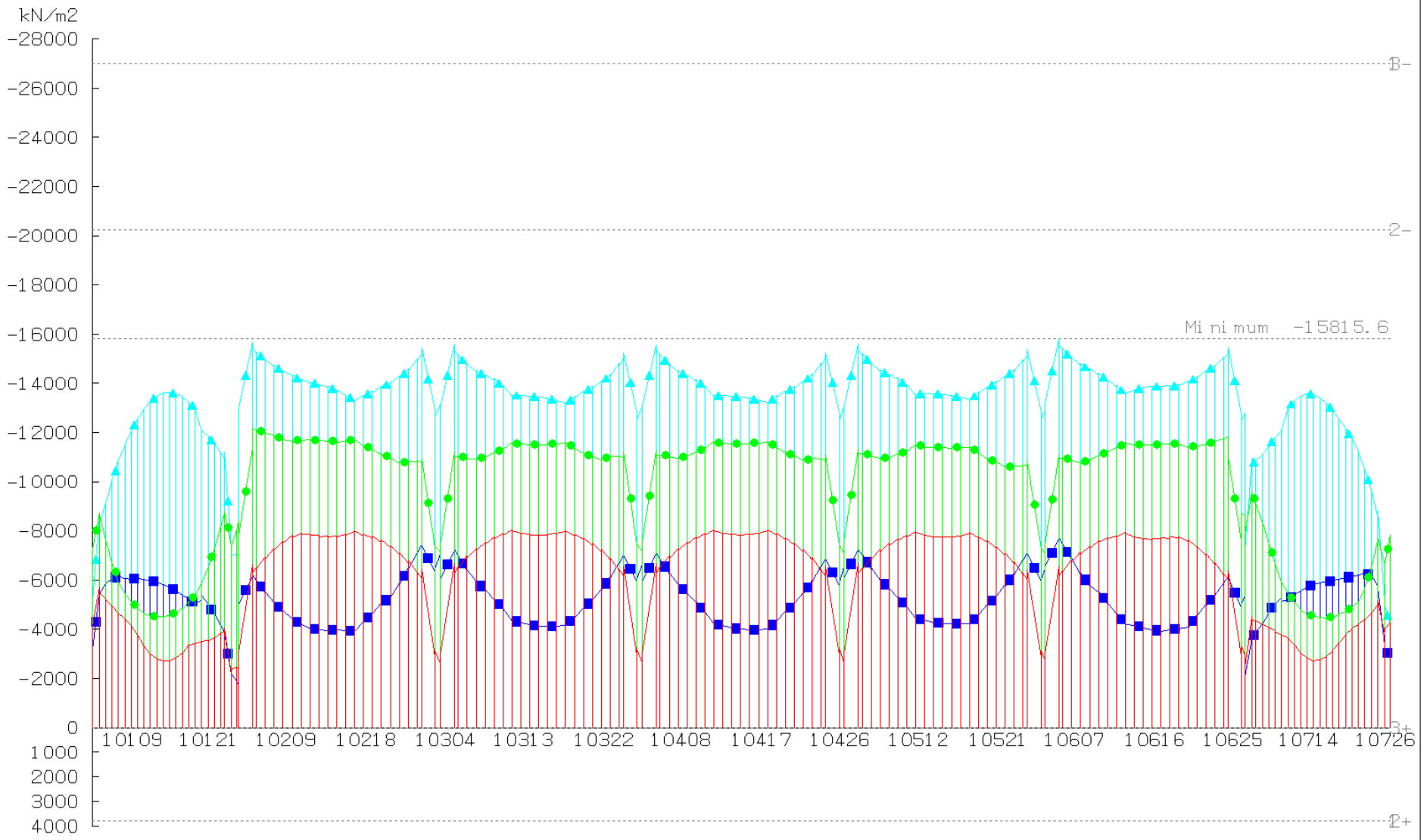
Сумирани приказ квази сталних комбинација које улазе у анвелопу за проверу граничног стања употребљивости (SLS-quasi-permanent)/

Quasi-permanent combinations for SLS check:

rule	Load Case	SLS	
		Comb 23	Comb 24
		quasi perm.	
Add	SUM-SW	1/1	1/1
Add	SUM-PT	0.90/1.10	0.90/1.10
Add	SDL	1/1	1/1
Add	CS	1/1	1/1
Add	CSinf		1/1
And	Csinf		
And	LM1-TS		
And	LM1-UDL	0.20	0.20
And	Pedestrian Load 3kN/m^2		
And	Traction and breaking		
And	FLM3		
And	Wind without traffic		
And	Wind with traffic		
And	Thermal	0.50	0.50

Rule –

правило додавања оптерећења, безусловно или само за повољно дејство. Скупљање и течење се узима у оба случаја, као безусловно и као повољно дејство. Безусловно је са rule-add, повољно је са rule-and. / rule for adding loads into combinations, unconditionally ot only favoruable case. Creep and shrinkage is taken double, one combination is with unconditional case and other only for favourable effect.



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

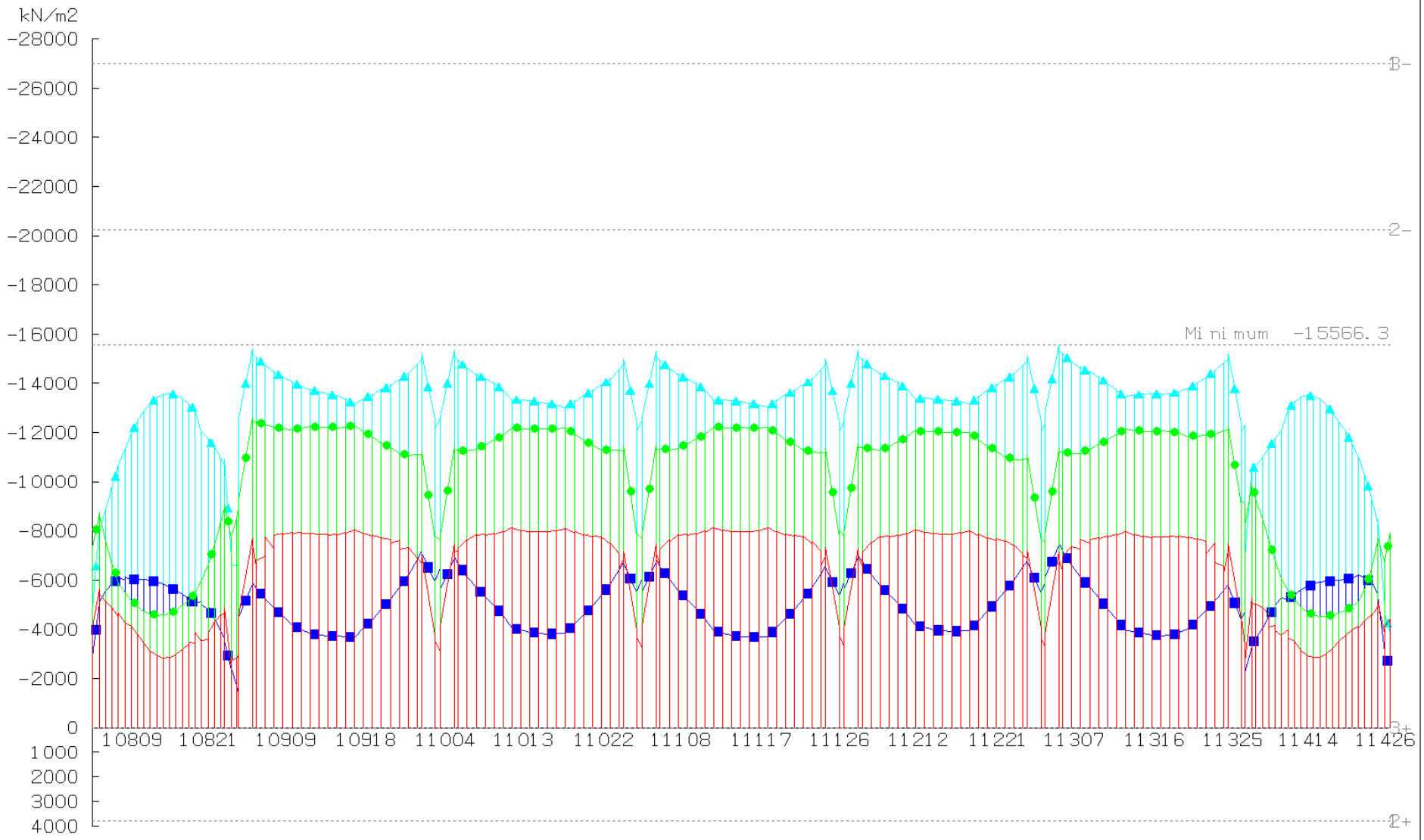
RmSet: 03-Girdl, Stage: A3-SLS-qu-perm

(DefaultSchedule)/A3-SLS-qu-perm-G1

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

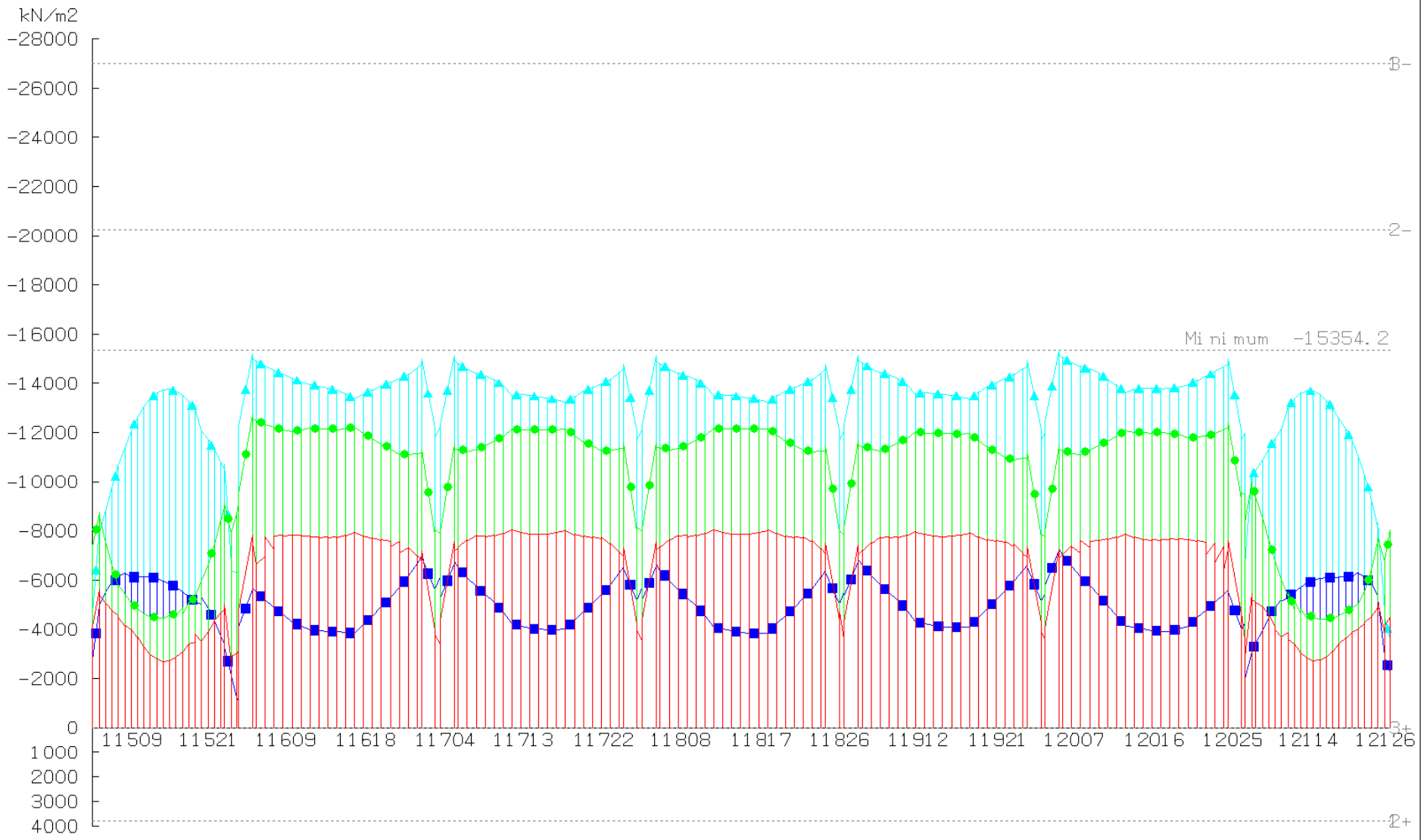
RmSet: 03-Gird2, Stage: A3-SLS-qu-perm

(DefaultSchedule)/A3-SLS-qu-perm-G2

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

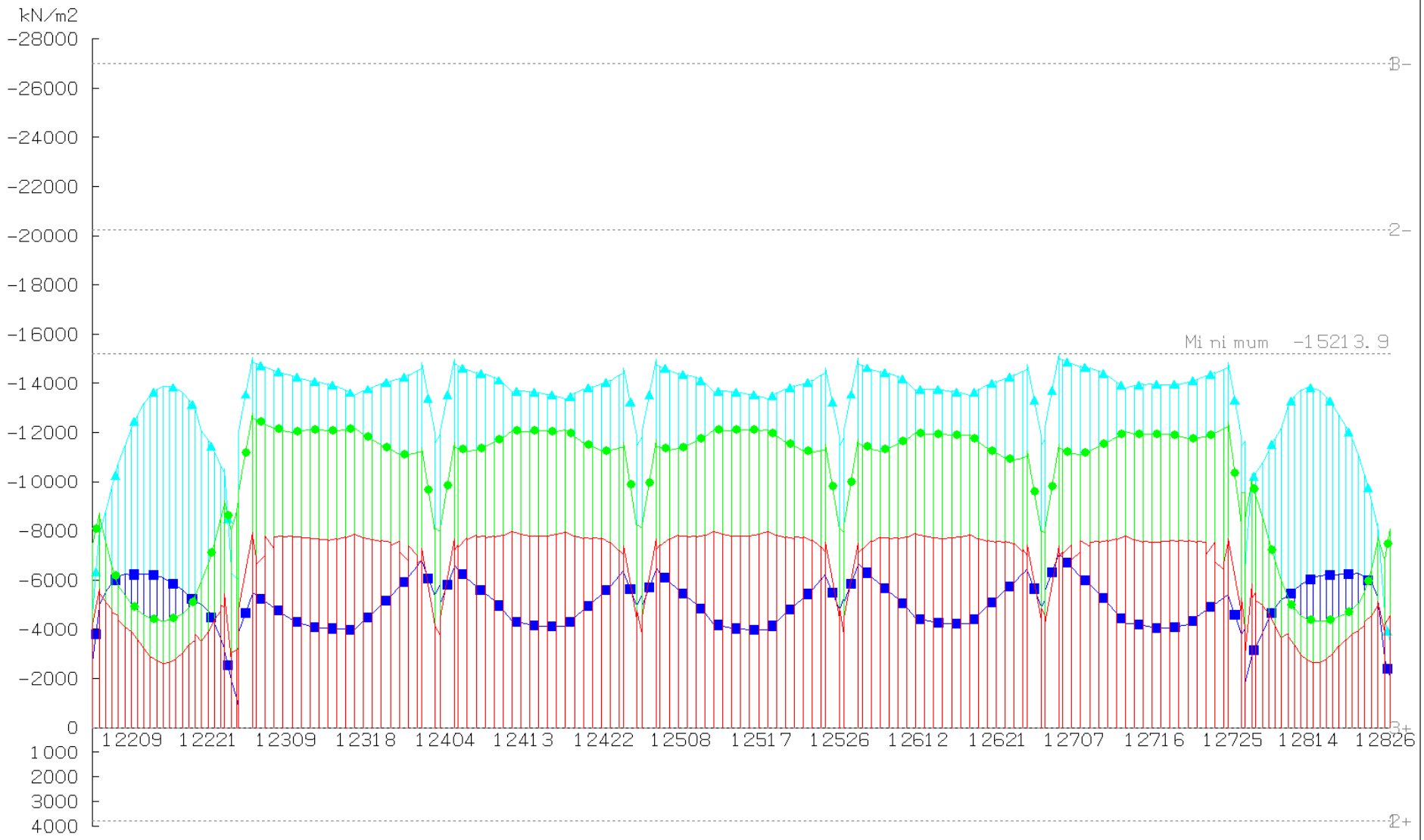
RmSet: 03-Gird3, Stage: A3-SLS-qu-perm

(DefaultSchedule)/A3-SLS-qu-perm-G3

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

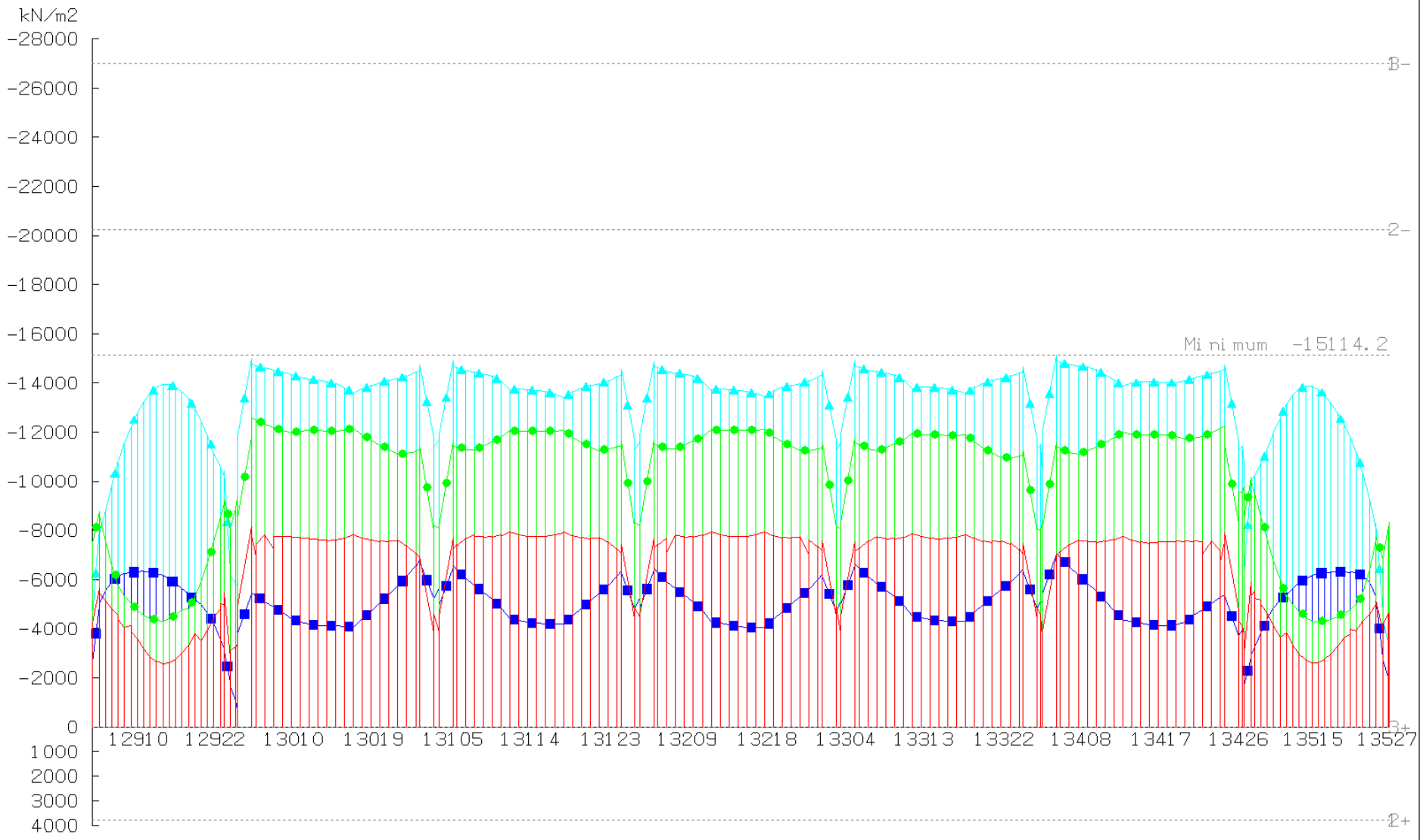
RmSet: 03-Gird4, Stage: A3-SLS-qu-perm

(DefaultSchedule)/A3-SLS-qu-perm-G4

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

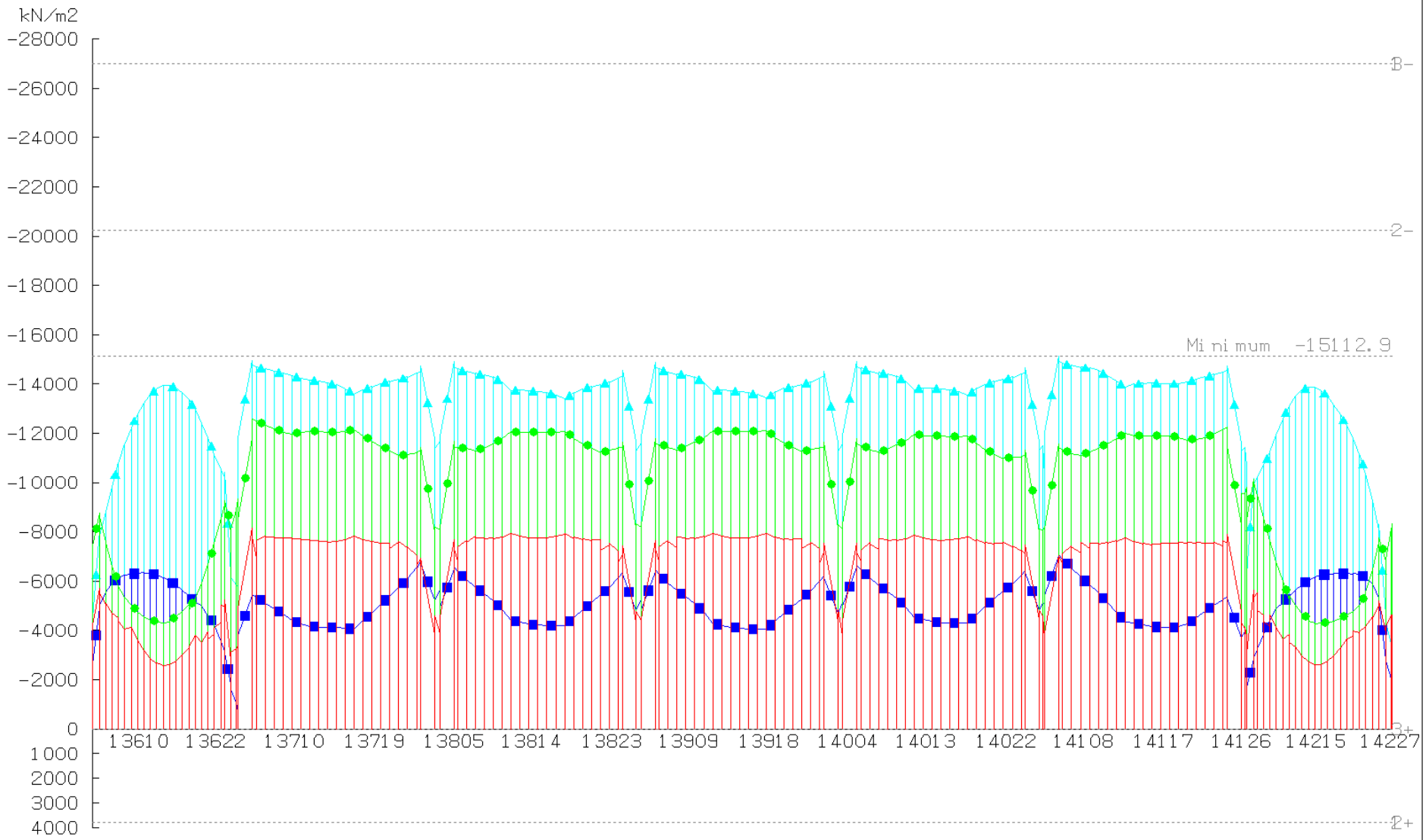
RmSet: 03-Gird5, Stage: A3-SLS-qu-perm

(DefaultSchedule)/A3-SLS-qu-perm-G5

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

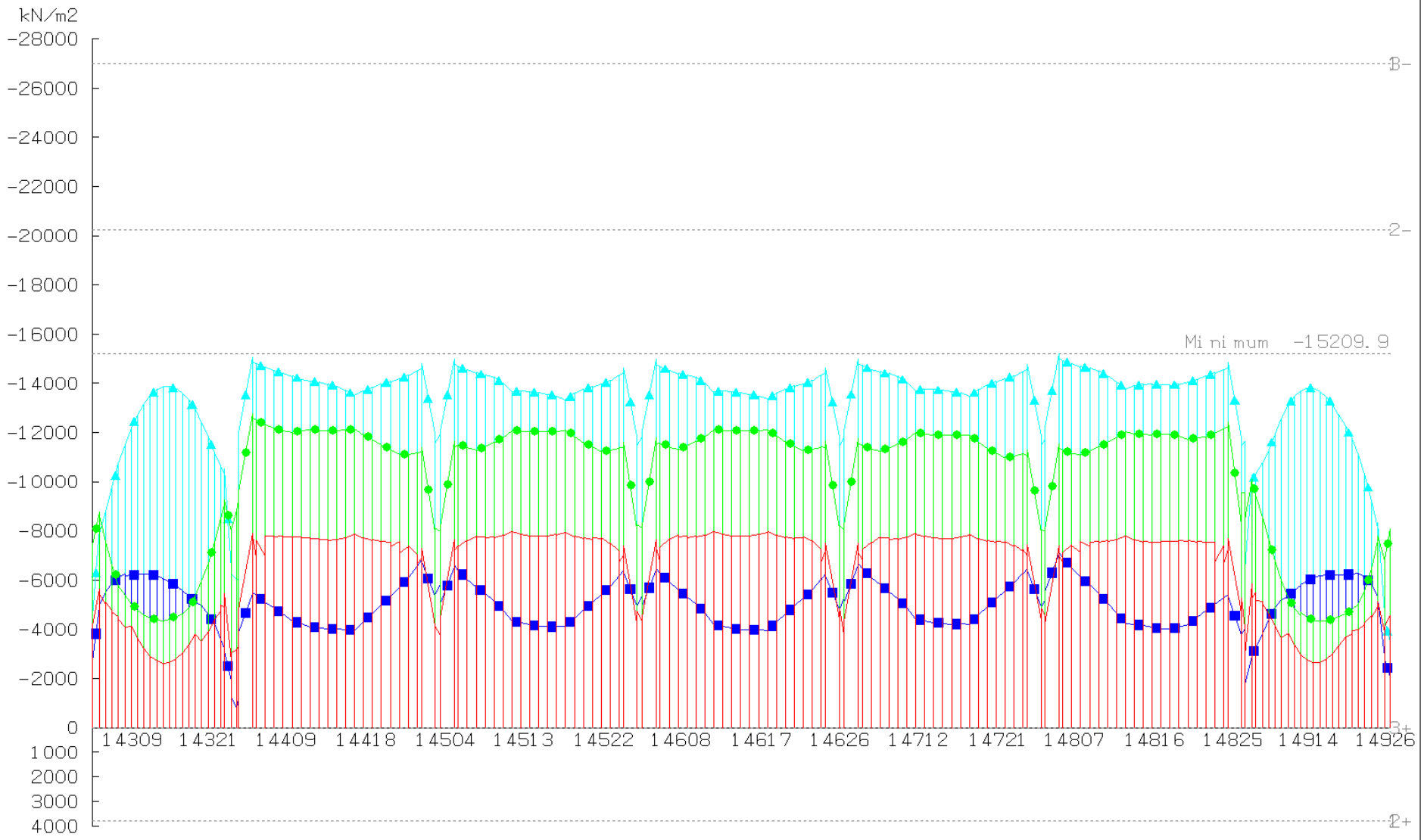
RmSet: 03-Gird6, Stage: A3-SLS-qu-perm

(DefaultSchedule)/A3-SLS-qu-perm-G6

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

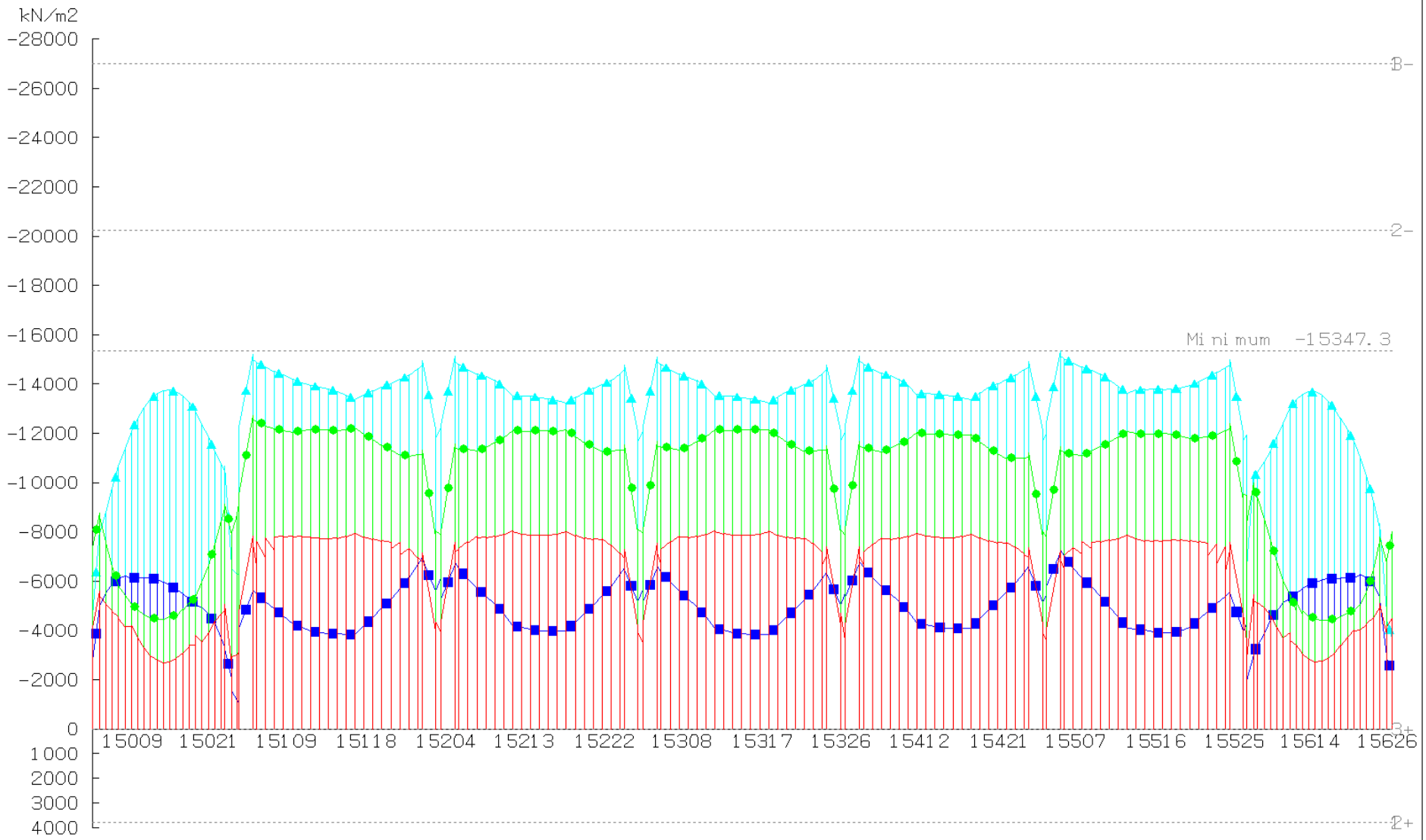
RmSet: 03-Gird7, Stage: A3-SLS-qu-perm

(DefaultSchedule)/A3-SLS-qu-perm-G7

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

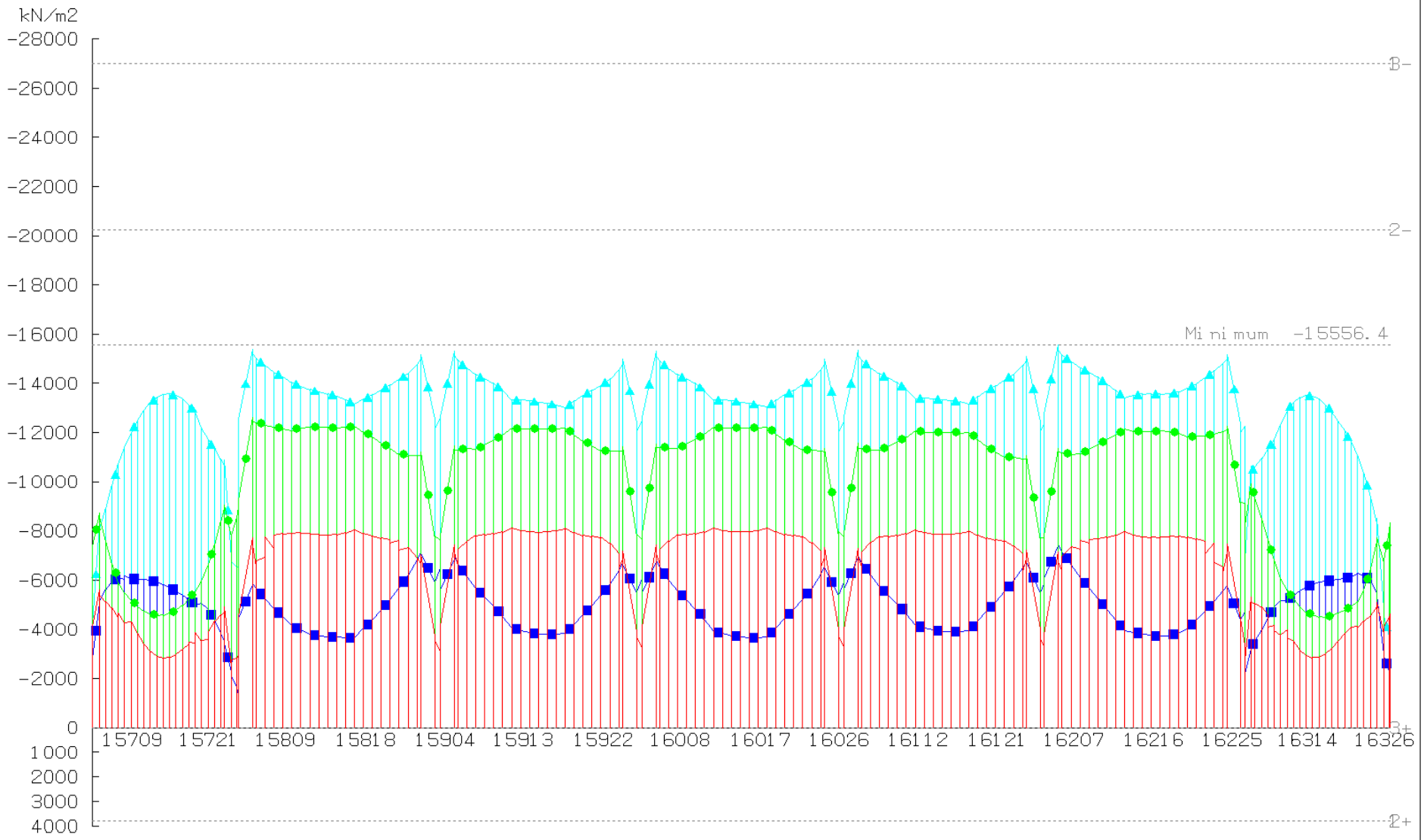
RmSet: 03-Gird8, Stage: A3-SLS-qu-perm

(DefaultSchedule)/A3-SLS-qu-perm-G8

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

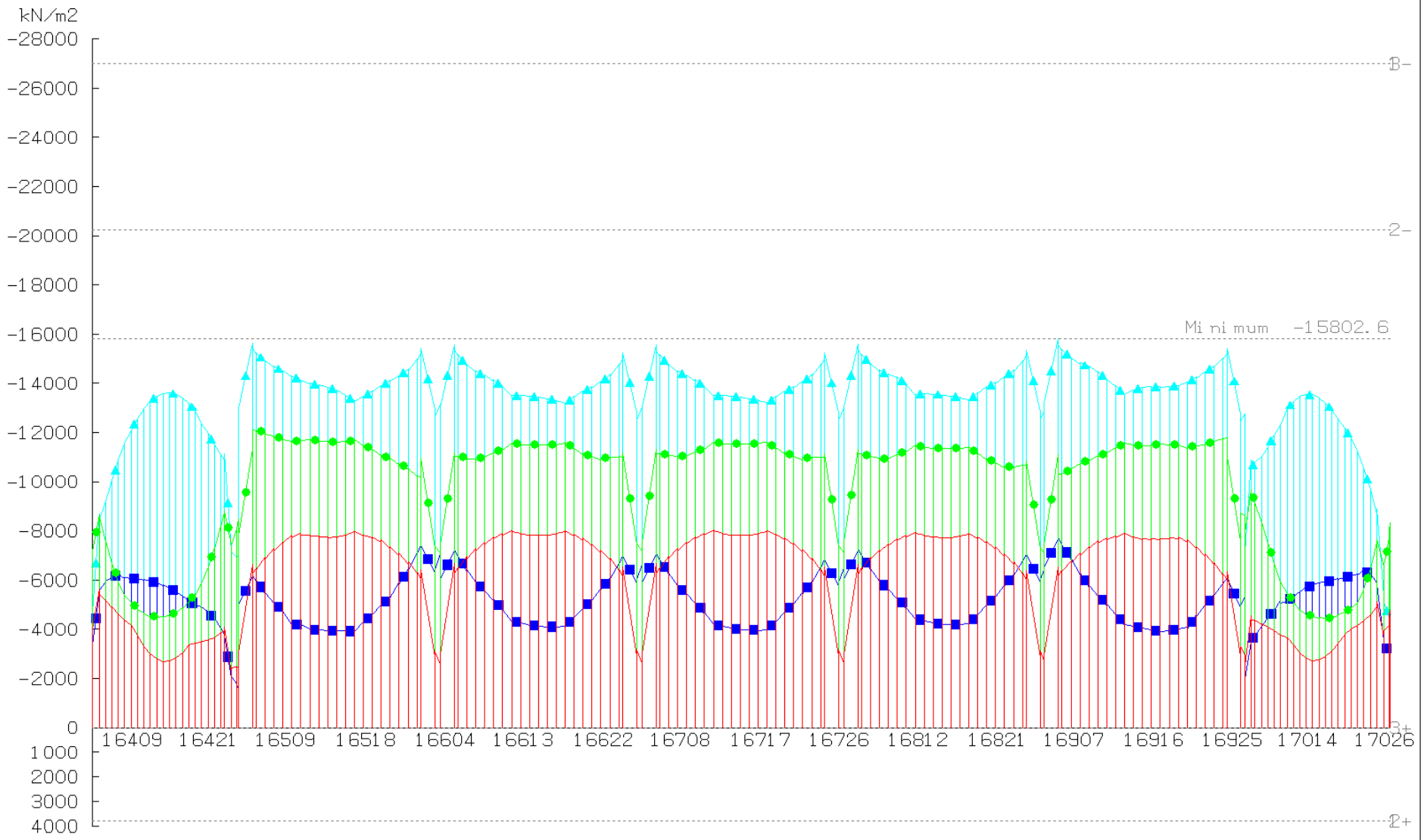
RmSet: 03-Gird9, Stage: A3-SLS-qu-perm

(DefaultSchedule)/A3-SLS-qu-perm-G9

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 03-Gird10, Stage: A3-SLS-qu-perm

(DefaultSchedule)/A3-SLS-qu-perm-G10

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50

4.4.2.5. Контрола замора

Fatigue limit state

ЛЕГЕНДА /LEGEND:

Stress2:S2-B(max/min) - **максимални и минимални напони у доњем влакну** /
Maximum and minimum values at bottom fiber

$$\sigma_{c\text{-}max}/f_{cd,fat} < 0.5+0.45*\sigma c\text{-}min/fcd,fat$$

Сумирани приказ комбинација које улазе у анвелопу за проверу замора /

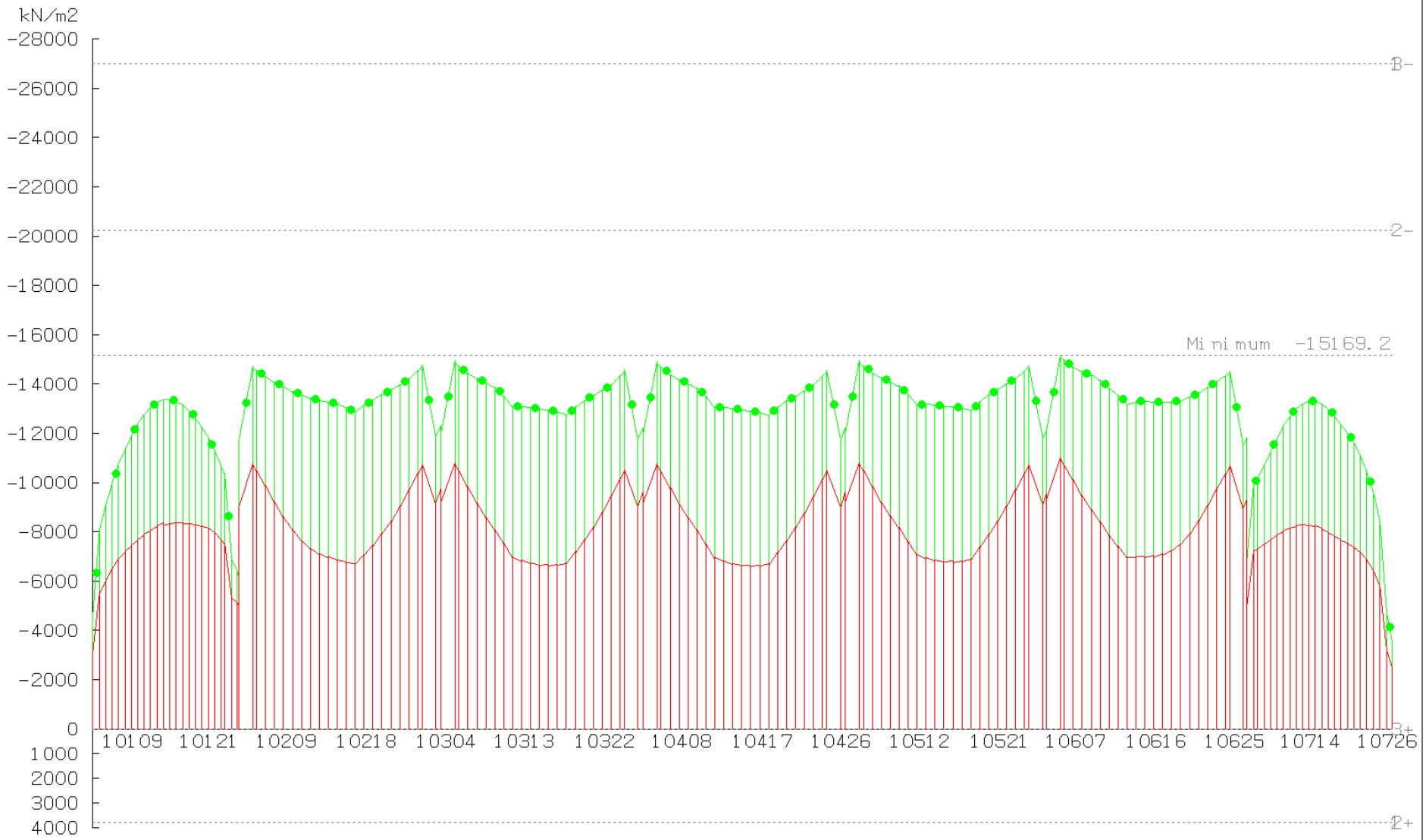
Fatigue check:

rule	Load Case	Fatigue	
		Comb 37	Comb 38
		resistance	
Add	Self weight	1/1	1/1
Add	Presstresing	0.90/1.10	0.90/1.10
Add	SDL	1/1	1/1
Add	CS	1	1
Add	CSinf		1
And	Csinf		
And	LM1-TS		
And	LM1-UDL		
And	Pedestrian Load		
And	Traction and breaking		
And	Centrifugal forces		
And	FLM3	1	1
And	Wind without traffic		
And	Wind with traffic		
And	Thermal		

Ознаке/Legend:

Rule –

правило додавања оптерећења, безусловно или само за повољно дејство. Скупљање и течење се узима у оба случаја, као безусловно и као повољно дејство. Безусловно је са rule-add, повољно је са rule-and. / rule for adding loads into combinations, unconditionally ot only favoruable case. Creep and shrinkage is taken double, one combination is with unconditional case and other only for favourable effect.



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

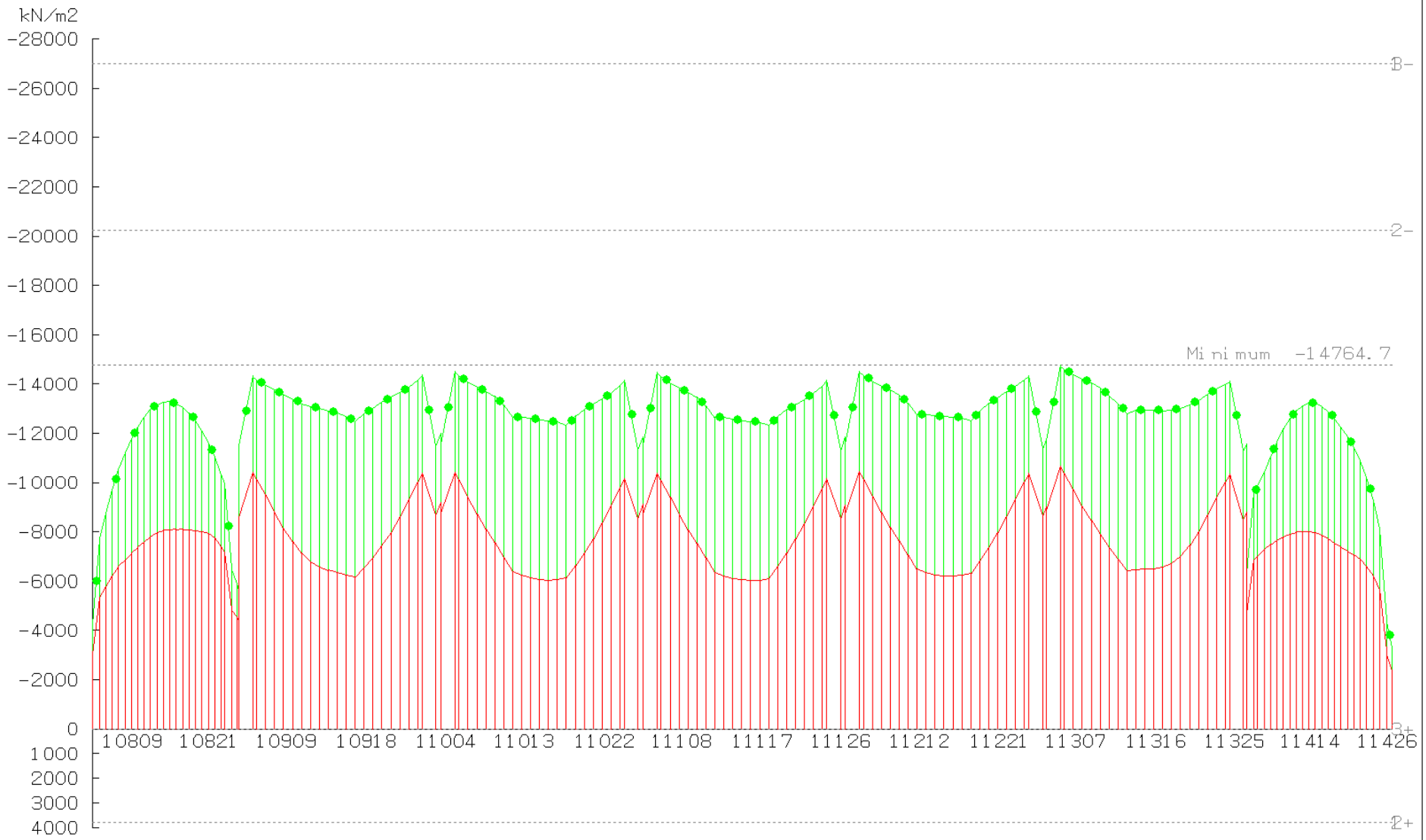
RmSet: 04-Gird1-comb37, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G1-37

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



Comb37.sup
Max
Stress2: S2-B
(-10677 , -2373)

Comb37.sup
Min
Stress2: S2-B
(-14765 , -3279)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

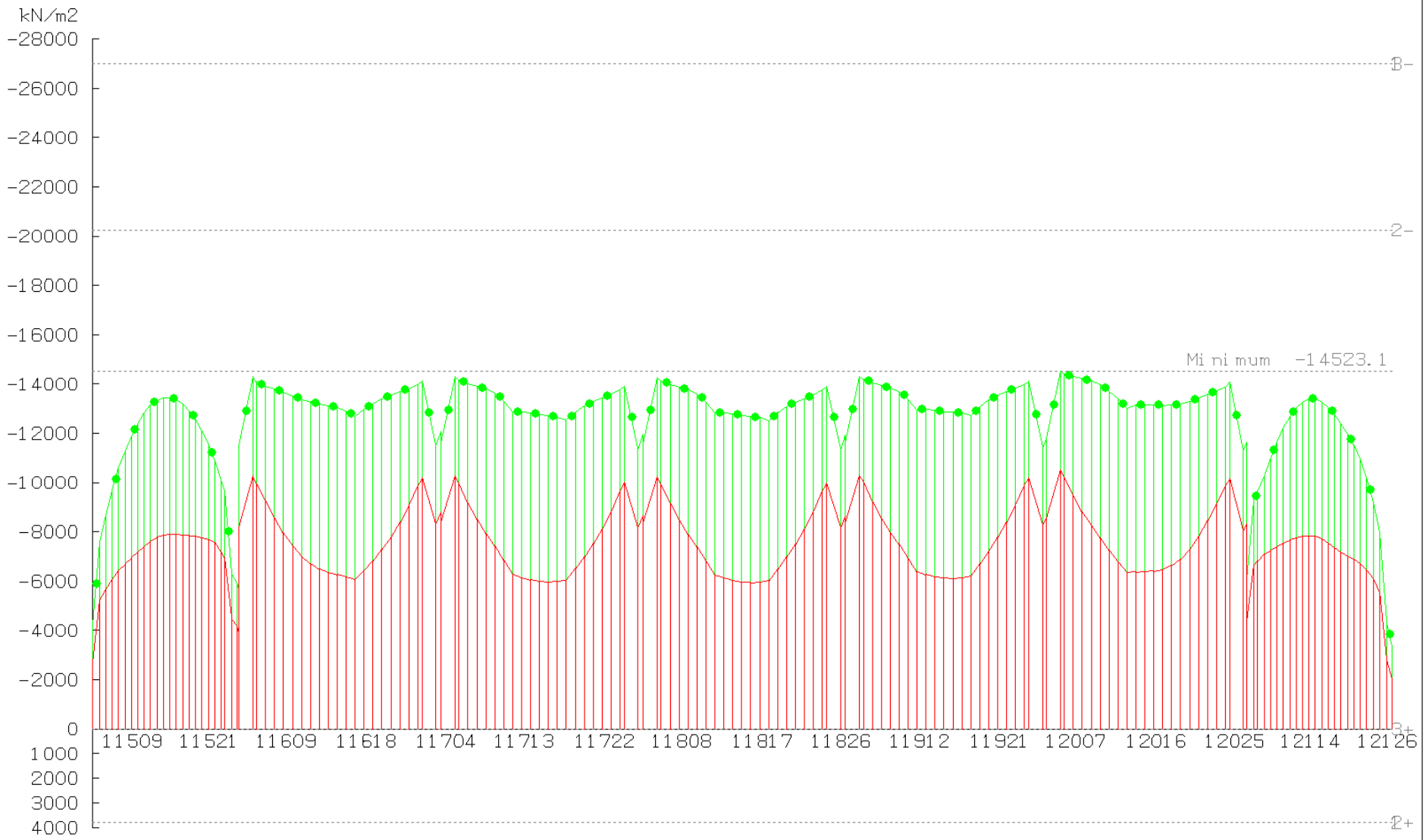
RmSet: 04-Gird2-comb37, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G2-37

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

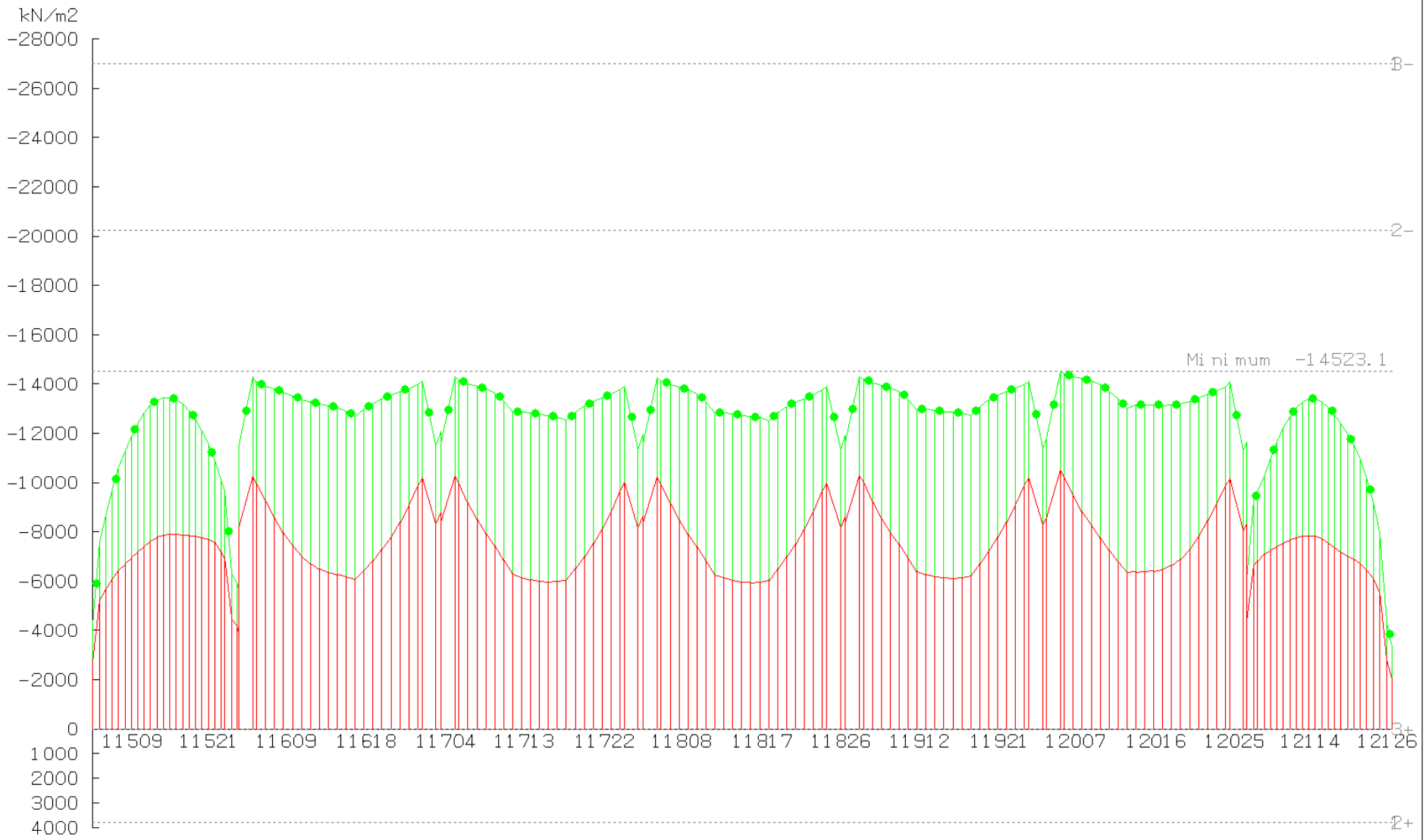
RmSet: 04-Gird3-comb37, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G3-37

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 04-Gird3-comb37, Stage: A4-Fatigue

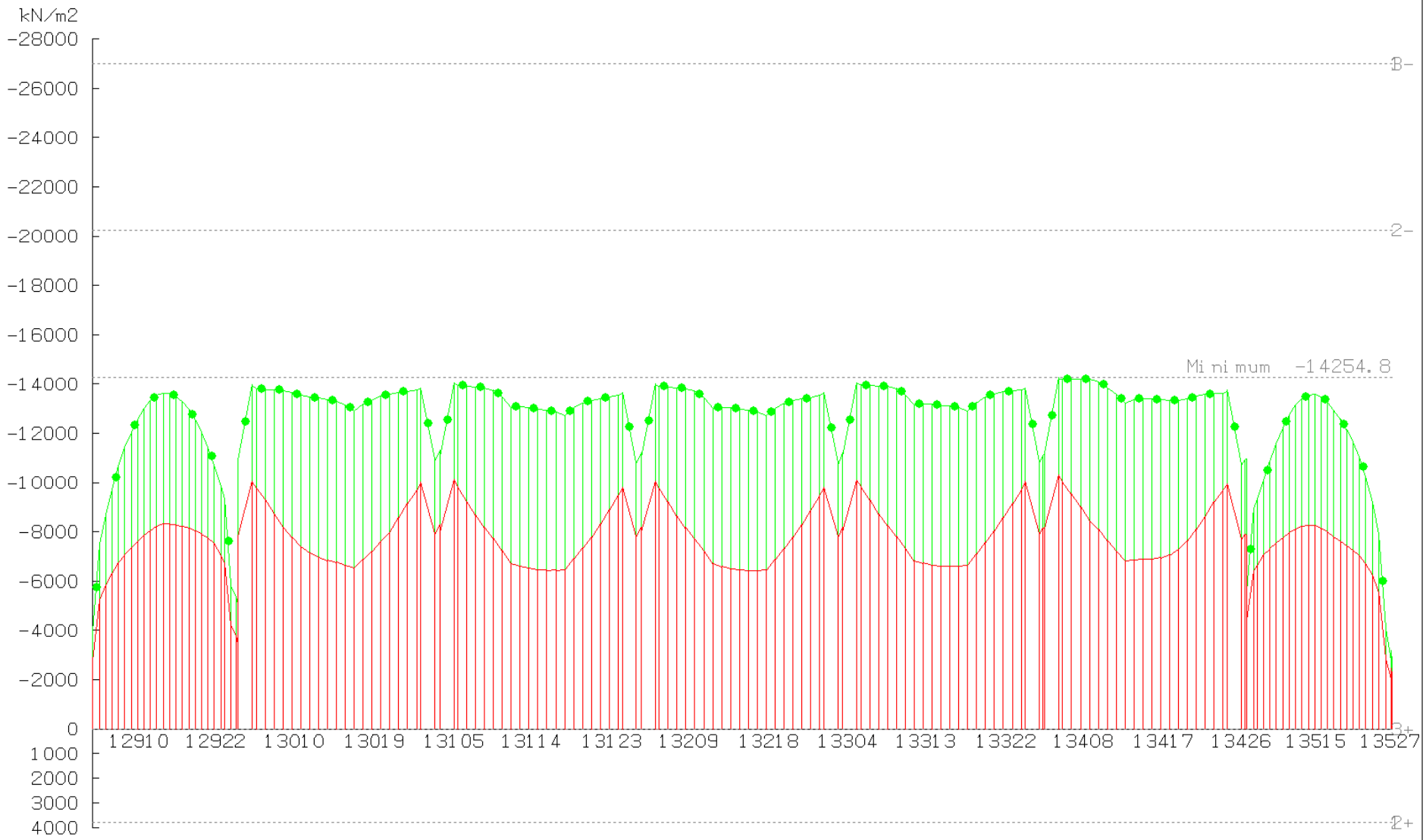
(DefaultSchedule)/A4-fatigue-G4-37

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50

RM Bridge Advanced CONNECT Edition
10.01.00.02



Comb37.sup
Max
Stress2: S2-B
(-10318 , -2038)

Comb37.sup
Min
Stress2: S2-B
(-14255 , -2712)

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 04-Gird5-comb37, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G5-37

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50

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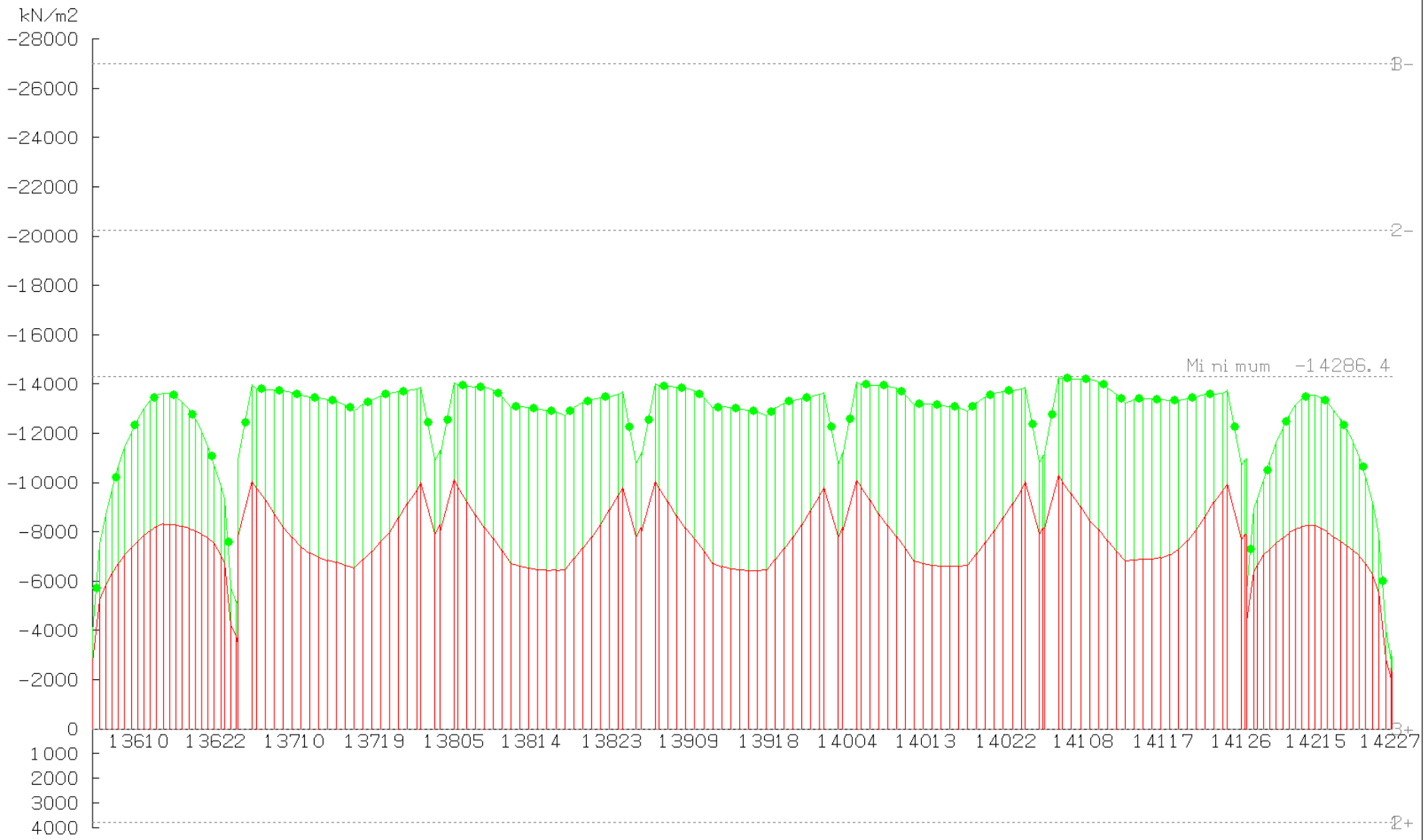
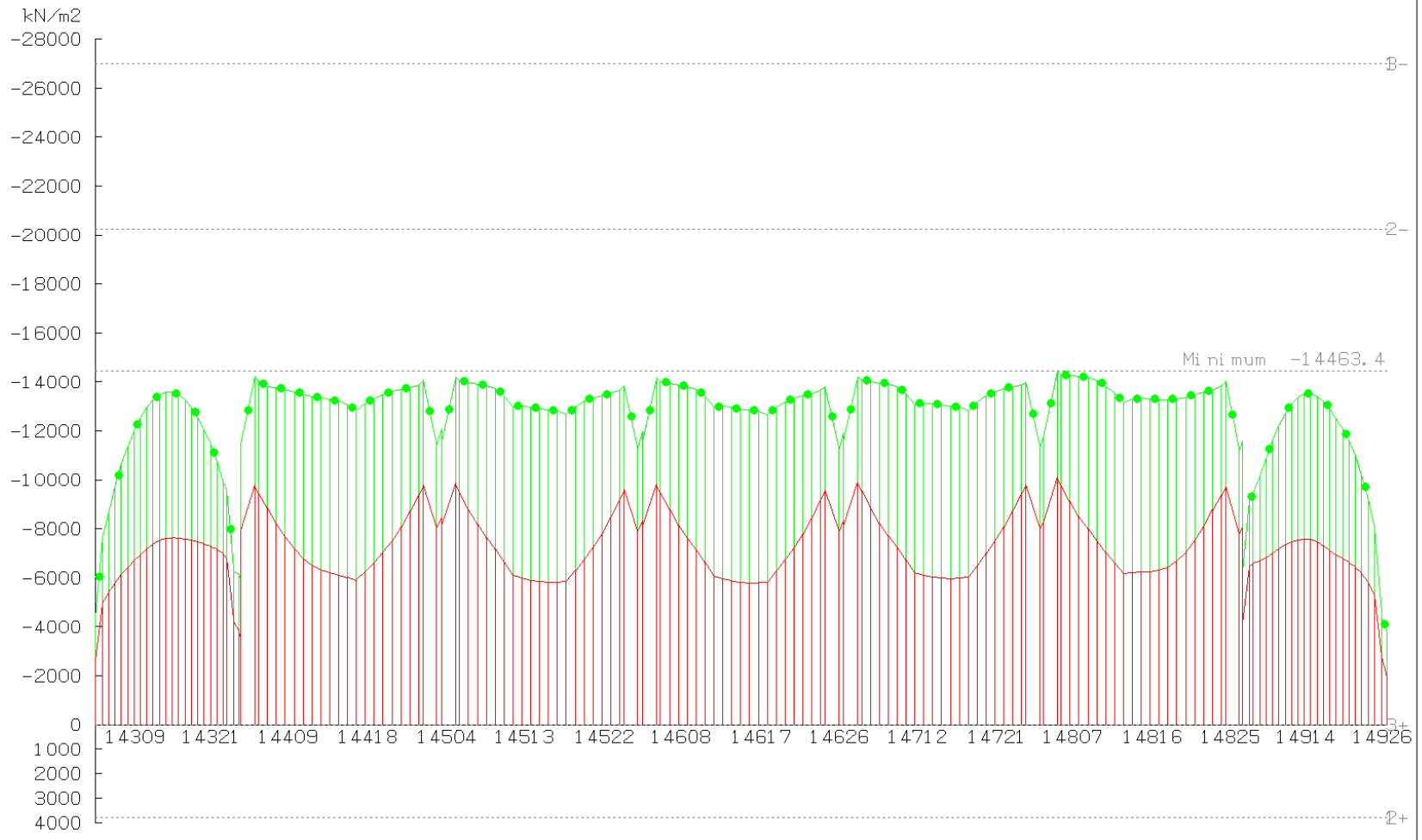
10.01.00.02


kN/m2
-28000
-26000
-24000
-22000
-20000
-18000
-16000
-14000
-12000
-10000
-8000
-6000
-4000
-2000
0
1000
2000
3000
4000
B-
2-
Minimum -14286.4
3+
2+
13610
13622
13710
13719
13805
13814
13823
13909
13918
14004
14013
14022
14108
14117
14126
14215
14227
Comb37.sup
Max
Stress2: S2-B
(-10317 , -2043)
Comb37.sup
Min
Stress2: S2-B
(-14286 , -2712)



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

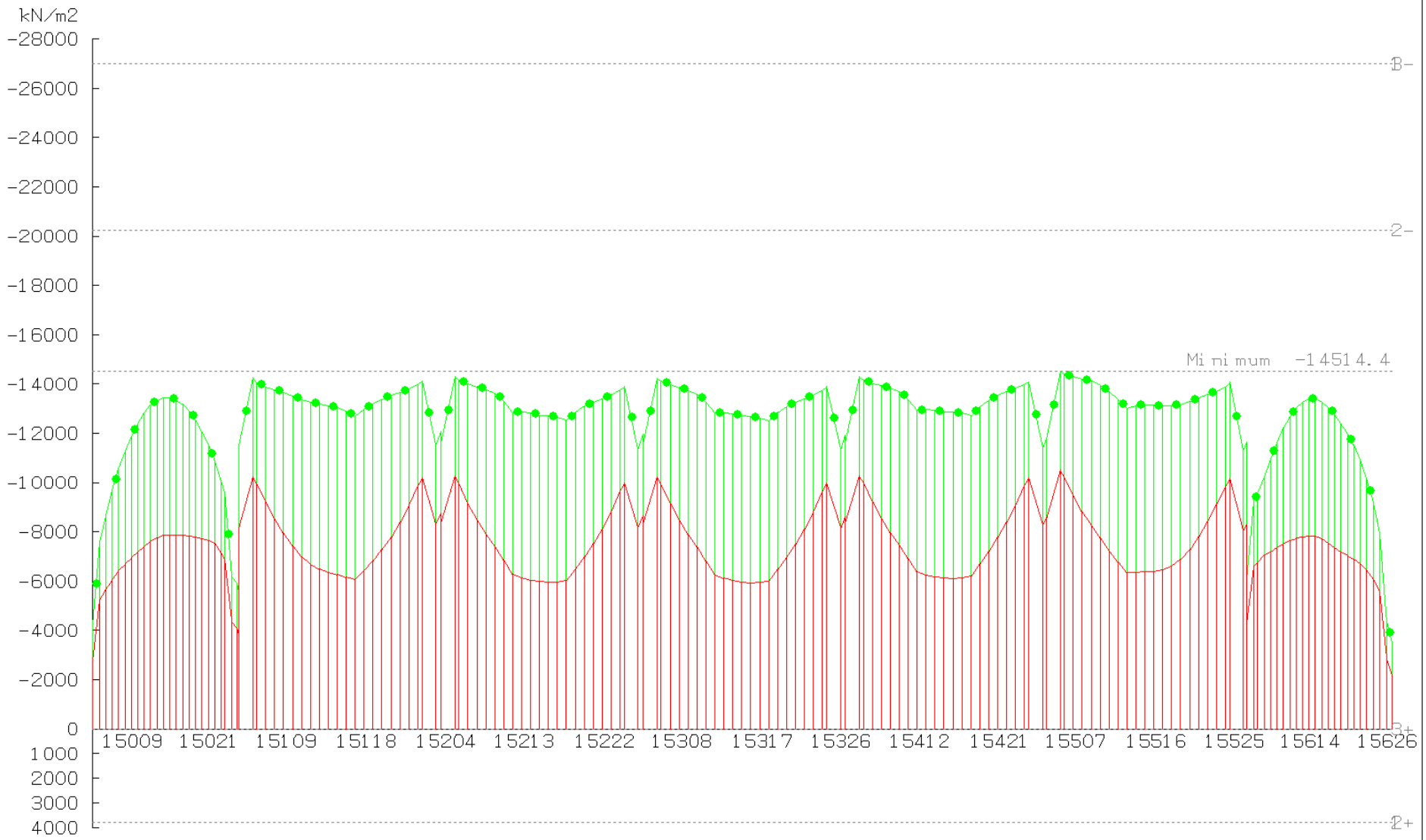
RmSet: 04-Gird7-comb37, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G7-37

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



Comb37.sup
Max
Stress2: S2-B
(-10508 , -2179)

Comb37.sup
Min
Stress2: S2-B
(-14514 , -3480)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

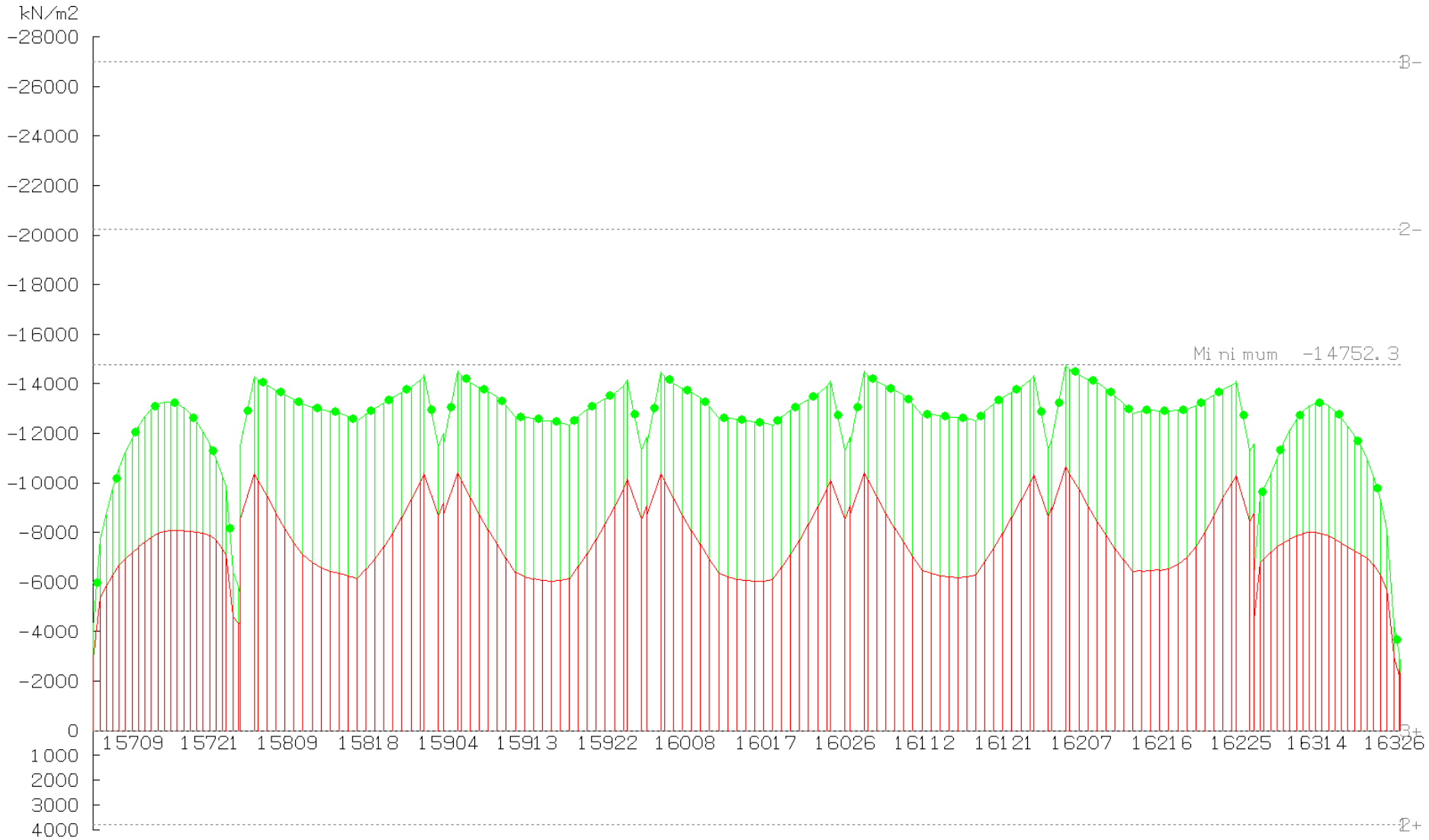
RmSet: 04-Gird8-comb37, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G8-37

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

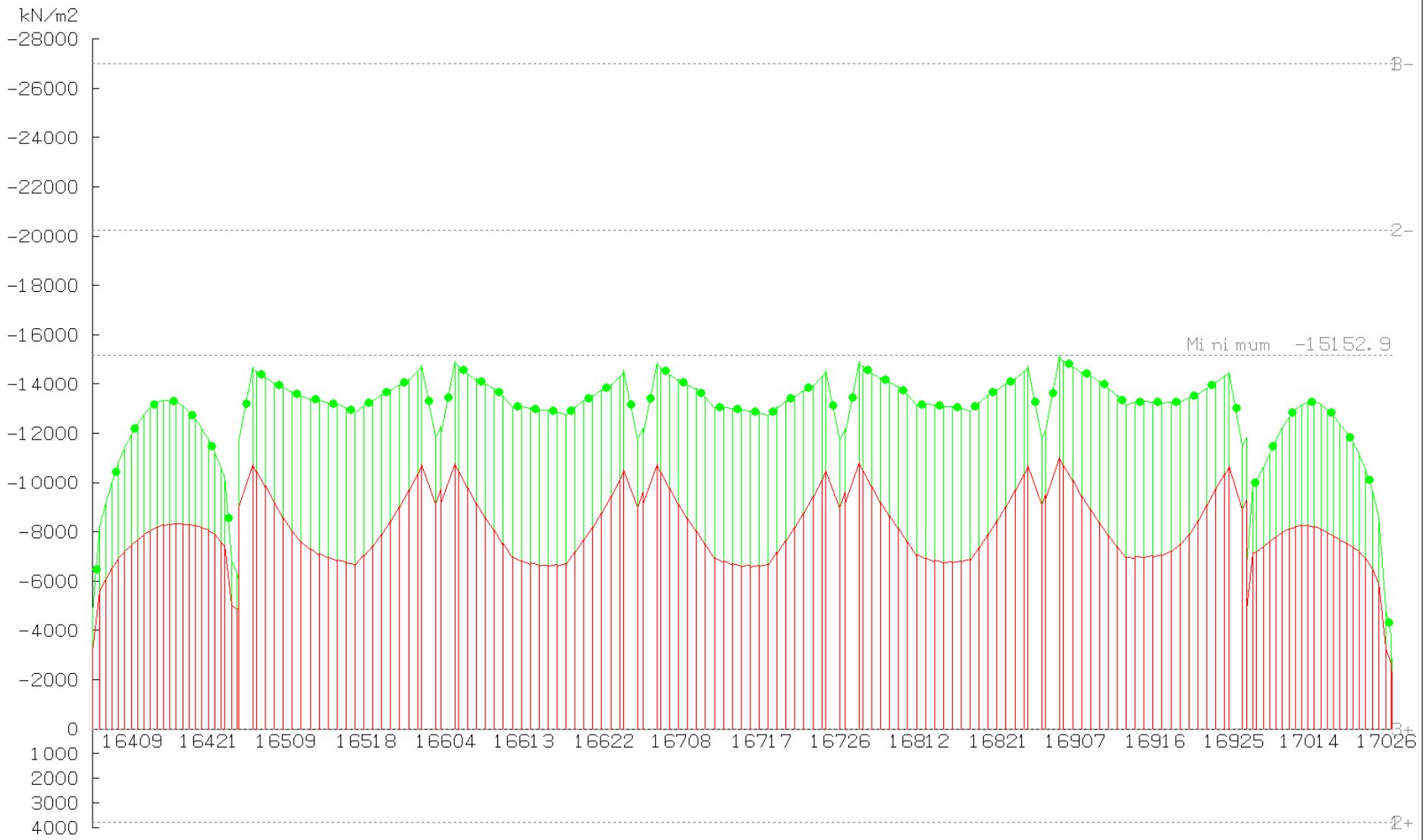
RmSet: 04-Gird9-comb37, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G9-37

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

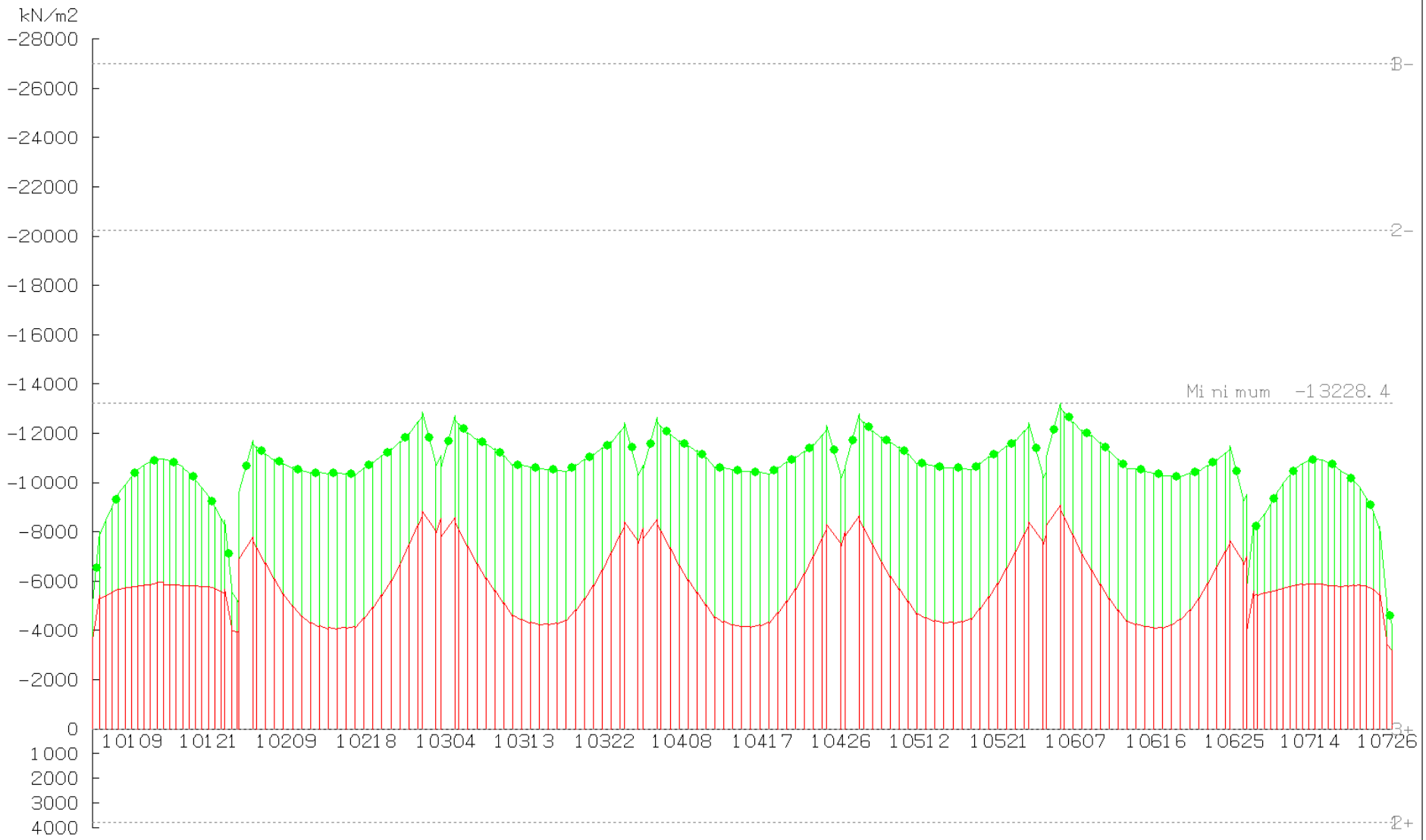
RmSet: 04-Gird10-comb37, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G10-37

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



Comb38.sup
Max
Stress2: S2-B
(-9096 , -3196)

Comb38.sup
Min
Stress2: S2-B
(-13228 , -4229)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

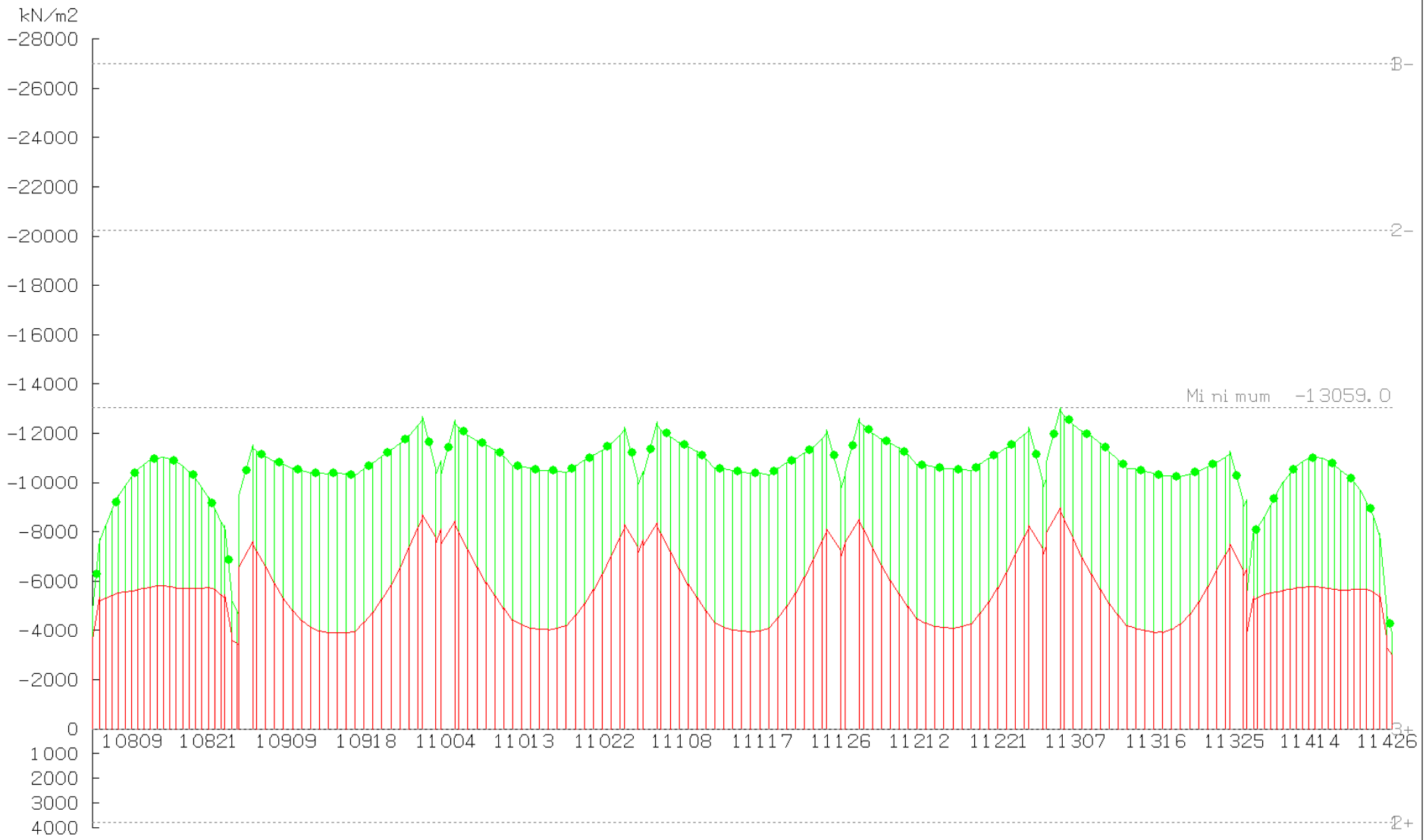
RmSet: 04-Gird1-comb38, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G1-38

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



Comb38.sup
Max
Stress2: S2-B
(-8971 , -3010)

Comb38.sup
Min
Stress2: S2-B
(-13059 , -3916)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

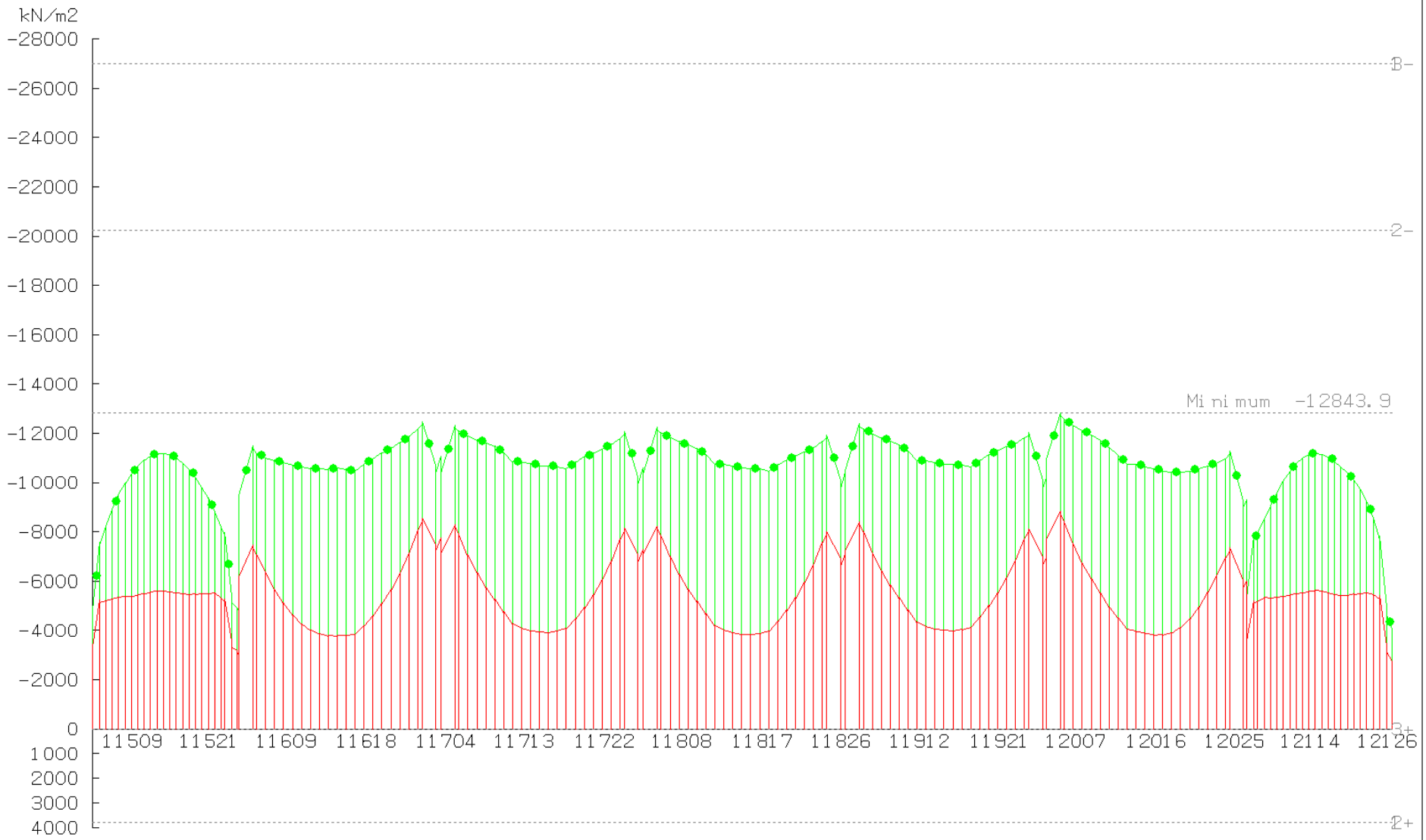
RmSet: 04-Gird2-comb38, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G2-38

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



Comb38.sup
Max
Stress2: S2-B
(-8837 , -2740)

Comb38.sup
Min
Stress2: S2-B
(-12844 , -4033)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

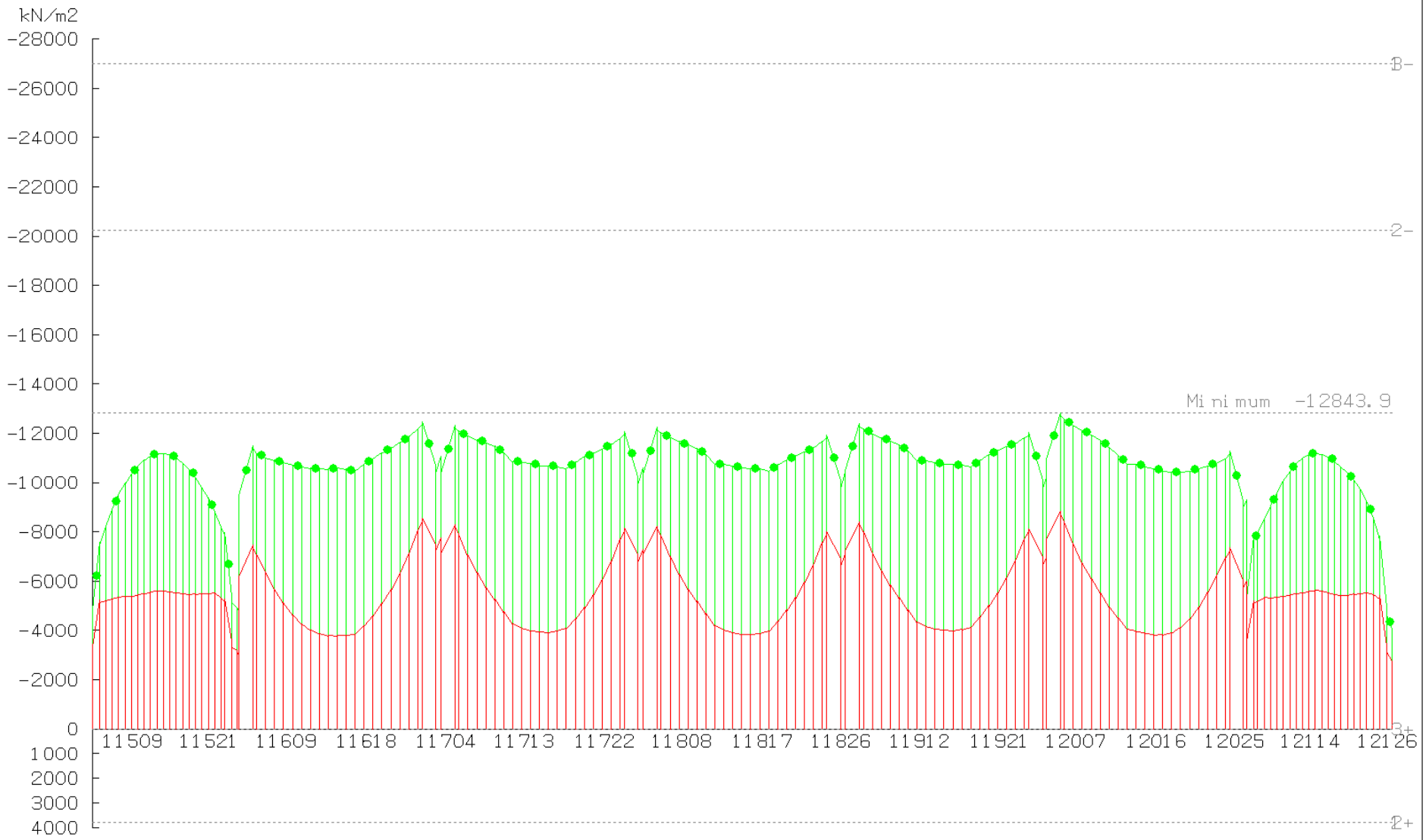
RmSet: 04-Gird3-comb38, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G3-38

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



Comb38.sup
Max
Stress2: S2-B
(-8837 , -2740)

Comb38.sup
Min
Stress2: S2-B
(-12844 , -4033)

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 04-Gird3-comb38, Stage: A4-Fatigue

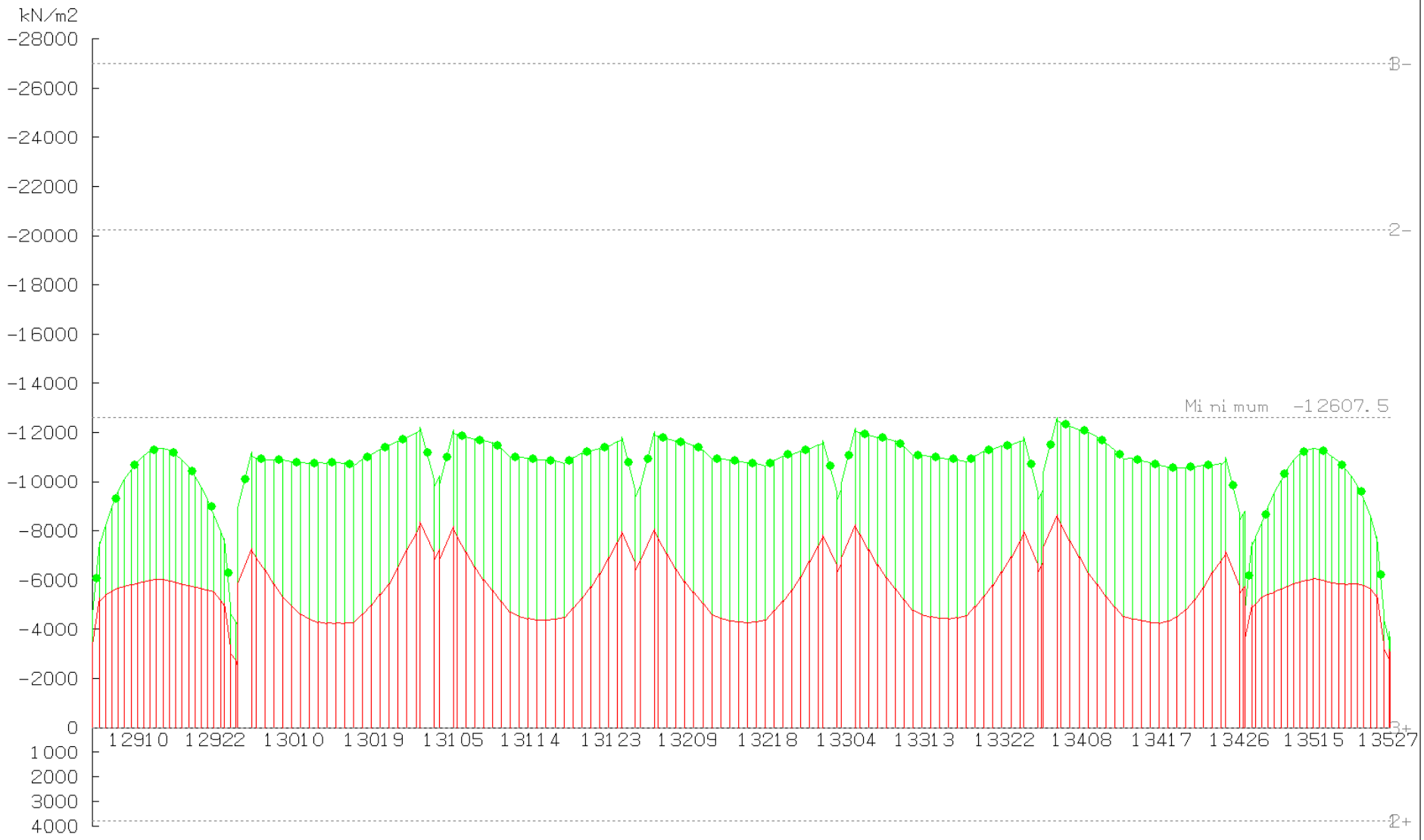
(DefaultSchedule)/A4-fatigue-G4-38

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50

RM Bridge Advanced CONNECT Edition
10.01.00.02



Comb38.sup
Max
Stress2: S2-B
(-8671 , -2503)

Comb38.sup
Min
Stress2: S2-B
(-12607 , -3467)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

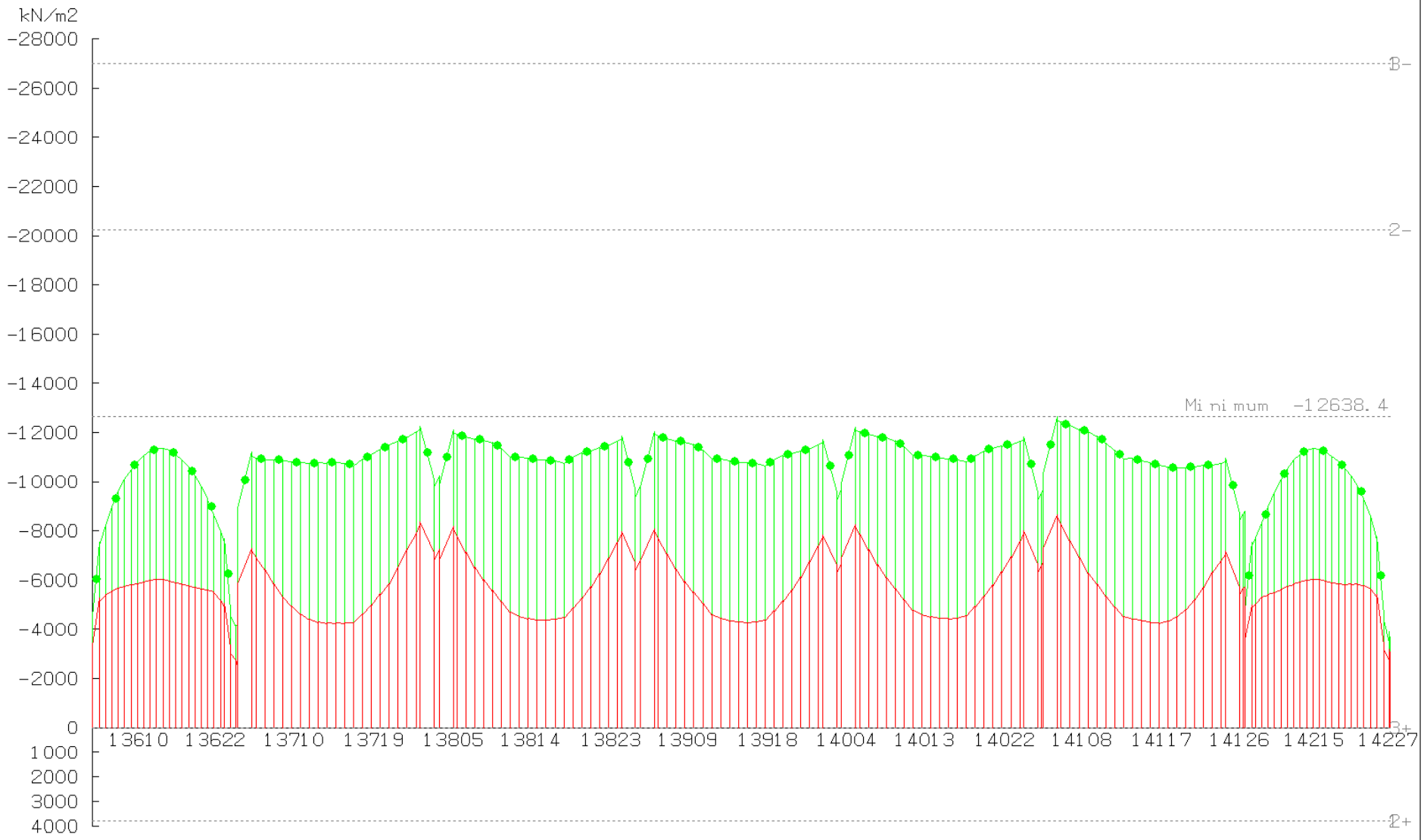
RmSet: 04-Gird5-comb38, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G5-38

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



Comb38.sup
Max
Stress2: S2-B
(-8669 , -2494)

Comb38.sup
Min
Stress2: S2-B
(-12638 , -3451)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

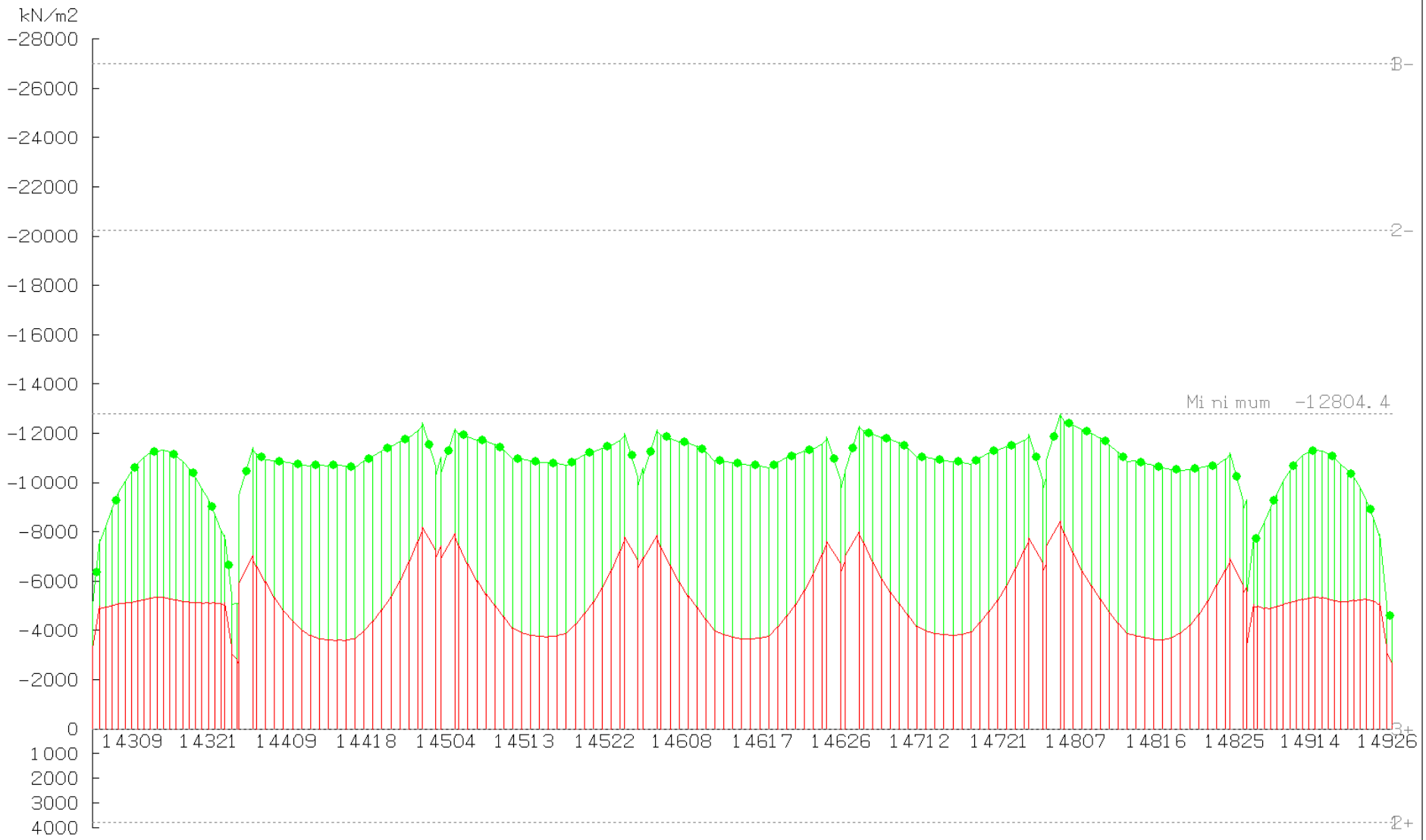
RmSet: 04-Gird6-comb38, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G6-38

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



Comb38.sup
Max
Stress2: S2-B
(-8453 , -2643)

Comb38.sup
Min
Stress2: S2-B
(-12804 , -4465)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

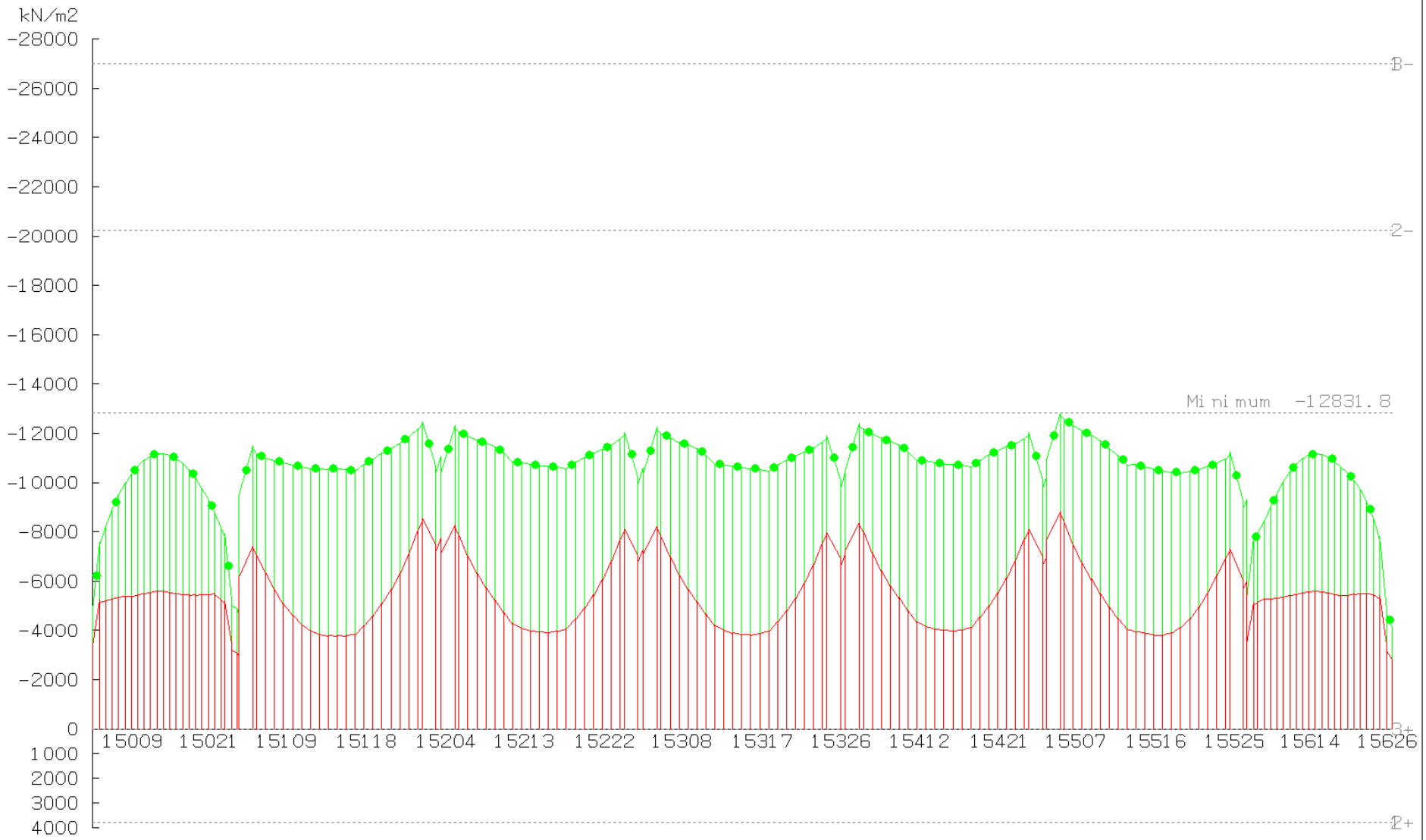
RmSet: 04-Gird7-comb38, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G7-38

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



Comb38.sup
Max
Stress2: S2-B
(-8825 , -2830)

Comb38.sup
Min
Stress2: S2-B
(-12832 , -4131)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

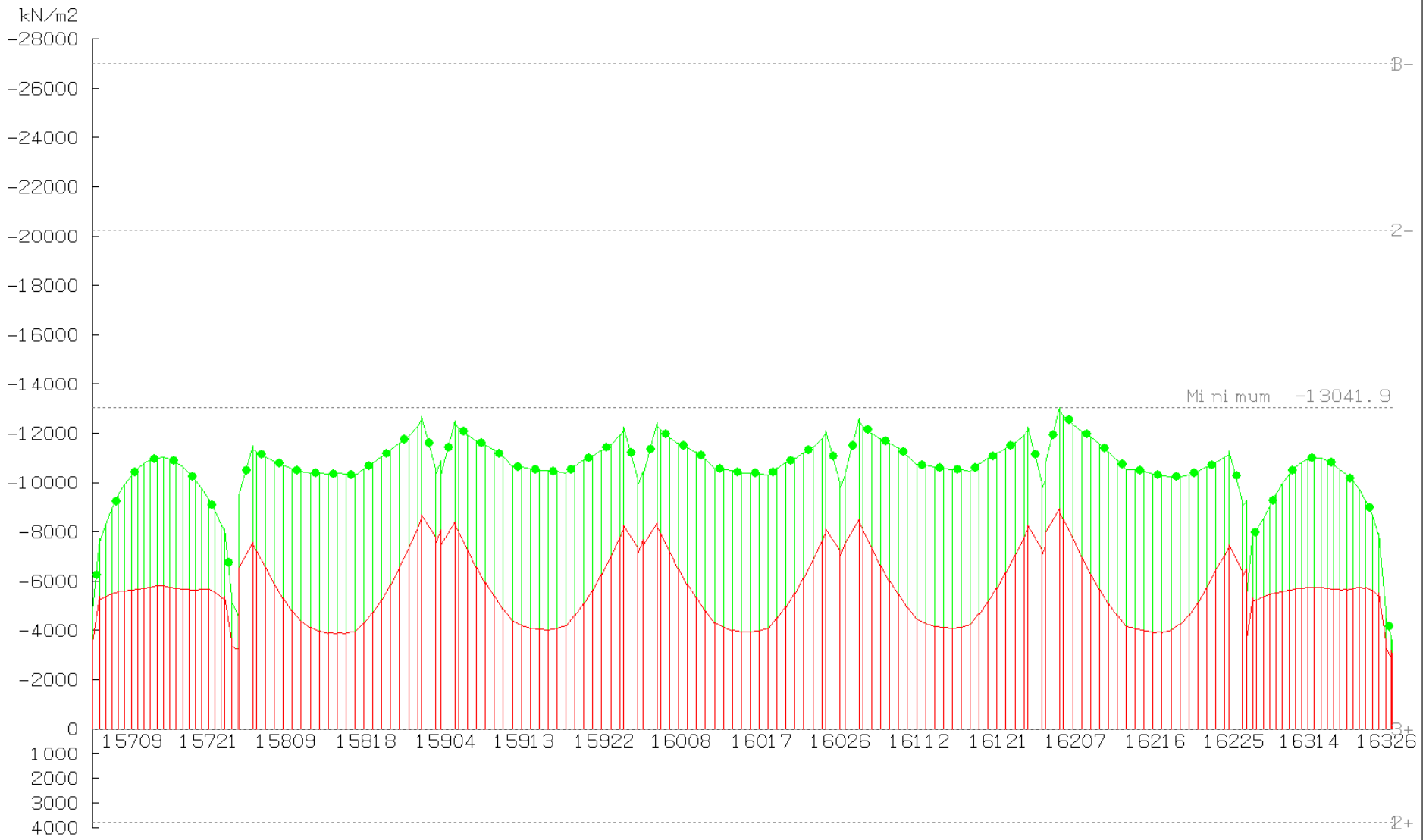
RmSet: 04-Gird8-comb38, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G8-38

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



Comb38.sup
Max
Stress2: S2-B
(-8955 , -2902)

Comb38.sup
Min
Stress2: S2-B
(-13042 , -3490)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

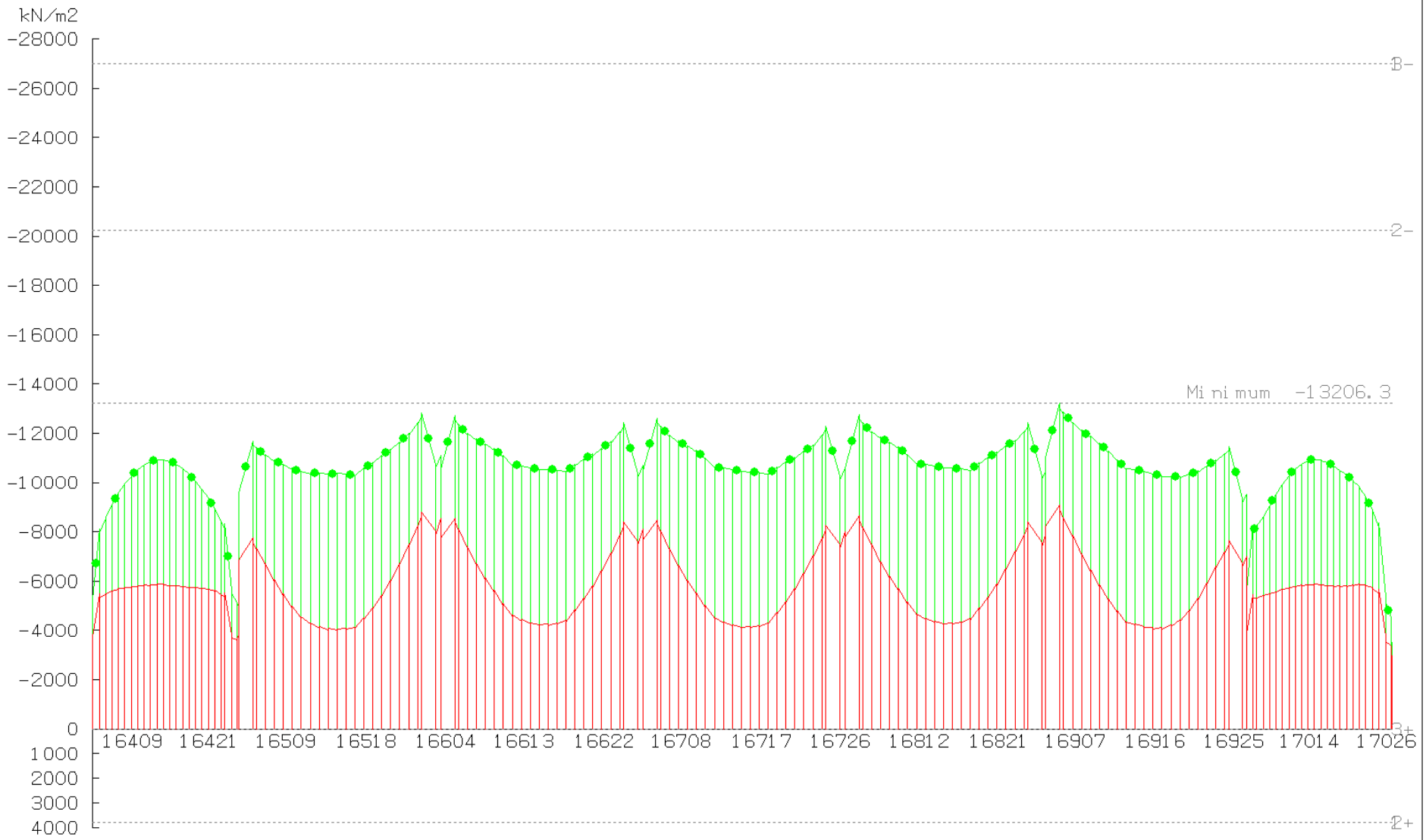
RmSet: 04-Gird9-comb38, Stage: A4-Fatigue

(DefaultSchedule)/A4-fatigue-G9-38

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



Comb38.sup
Max
Stress2: S2-B
(-9075 , -2900)

Comb38.sup
Min
Stress2: S2-B
(-13206 , -3412)

RH Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: 04-Gird10-comb38

04÷Fatigue! 04-Gird10-comb38

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

20/07/2021
13:46

Верификација чврстоће на замор при притиску бетона је извршена ако је испуњен следећи услов:/
Fatigue check is satisfied if the following equation states:

$$\frac{\sigma_{c,max}}{f_{cd,fat}} \leq 0.5 + 0.45 \cdot \frac{\sigma_{c,min}}{f_{cd,fat}} \leq 0.9 \; za \; f_{ck} \; \leq 50 \; MPa$$

$\sigma_{c,max}$ – **највећи напон притиска у неком влакну пресека за честу комбинацију оптерећења са возилом LM3 (притисак је позитиван)/**maximum concrete compressive stress under combination with LM3 load

$\sigma_{c,min}$ – **најмањи напон притиска у истом влакну пресека у којем се појављује $\sigma_{c,max}$/** minimum concrete compressive stress in same fiber

$\beta_{cc}(t0)$ – **коефицијент за чврстоћу бетона при првом оптерећењу** /coefficient for concrete strength when the first load is applied

$$\beta_{cc}(t0) = \exp\{s \cdot \left[1 - (\frac{28}{t})^{1/2}\right]\}$$

Где су /Where:

s – **коефицијент који зависи од типа цемента** /type of cement

t – **старост бетона, у данима** /concrete age in days

$f_{cd,fat}$ – **прорачунска чврстоћа при замору бетона** /design concrete strength for fatigue load

$$f_{cd,fat} = k1 \cdot \beta_{cc}(t0) \cdot f_{cd} \cdot (1 - \frac{f_{ck}}{250})$$

comb 37 RM Input

Girder	1	2	3	4	5	6	7	8	9	10
abs(σc)-max(MPa)	15.568	15.164	14.901	14.841	14.677	14.675	14.837	14.893	15.153	15.553
abs(σc)-min(MPa)	11.355	11.000	10.829	10.445	10.601	10.600	10.441	10.821	10.988	11.340
$\sigma_{c\text{-}max}/f_{cd,fat}$	0.731068	0.712096	0.699746	0.696928	0.689227	0.689133	0.696741	0.69937	0.71158	0.730364
$0.5+0.45*\sigma_{c\text{-}min}/f_{cd,fat}$	0.739952	0.73245	0.728837	0.720722	0.724019	0.723998	0.720638	0.728668	0.732197	0.739635

comb 38 RM Input

Girder	1	2	3	4	5	6	7	8	9	10
abs(σc)-max(MPa)	13.564	13.380	13.142	13.103	12.880	12.878	13.096	13.130	13.364	12.878
abs(σc)-min(MPa)	9.350	9.216	9.070	8.707	8.872	8.870	8.700	9.059	9.200	8.870
$\sigma_{c\text{-}max}/f_{cd,fat}$	0.636961	0.62832	0.617144	0.615313	0.604841	0.604747	0.614984	0.61658	0.627569	0.604747
$0.5+0.45*\sigma_{c\text{-}min}/f_{cd,fat}$	0.697583	0.694751	0.691666	0.683995	0.687482	0.68744	0.683847	0.691433	0.694413	0.68744

k1=	0.85		koeficijent definisan u nacionalnom aneksu
fck=	45.00	MPa	
t=	365.00	days	starost betona prilikom prvog opterecivanja pokretnim opterecenjem
s=	0.25		zavisi od tipa cementa = 0.2 for rapid hardening high-strength cements = 0.25 for normal and rapid hardening cements = 0.38 for slow hardening cements.
αcc=	0.85		
βcc(t0)=	1.20	MPa	
fcd= αcc x fck, cyl/γc =	25.50	MPa	
fcd,fat=	21.29	MPa	

4.4.2.6. Главни напони

Principle stresses

ЛЕГЕНДА /LEGEND:

Stress2:S2-C*y(max/min) - **максимални и минимални напони у тежишту** /
Maximum and minimum values at section centroid

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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 1, Part 2, STRESS, SLS-charac.sup

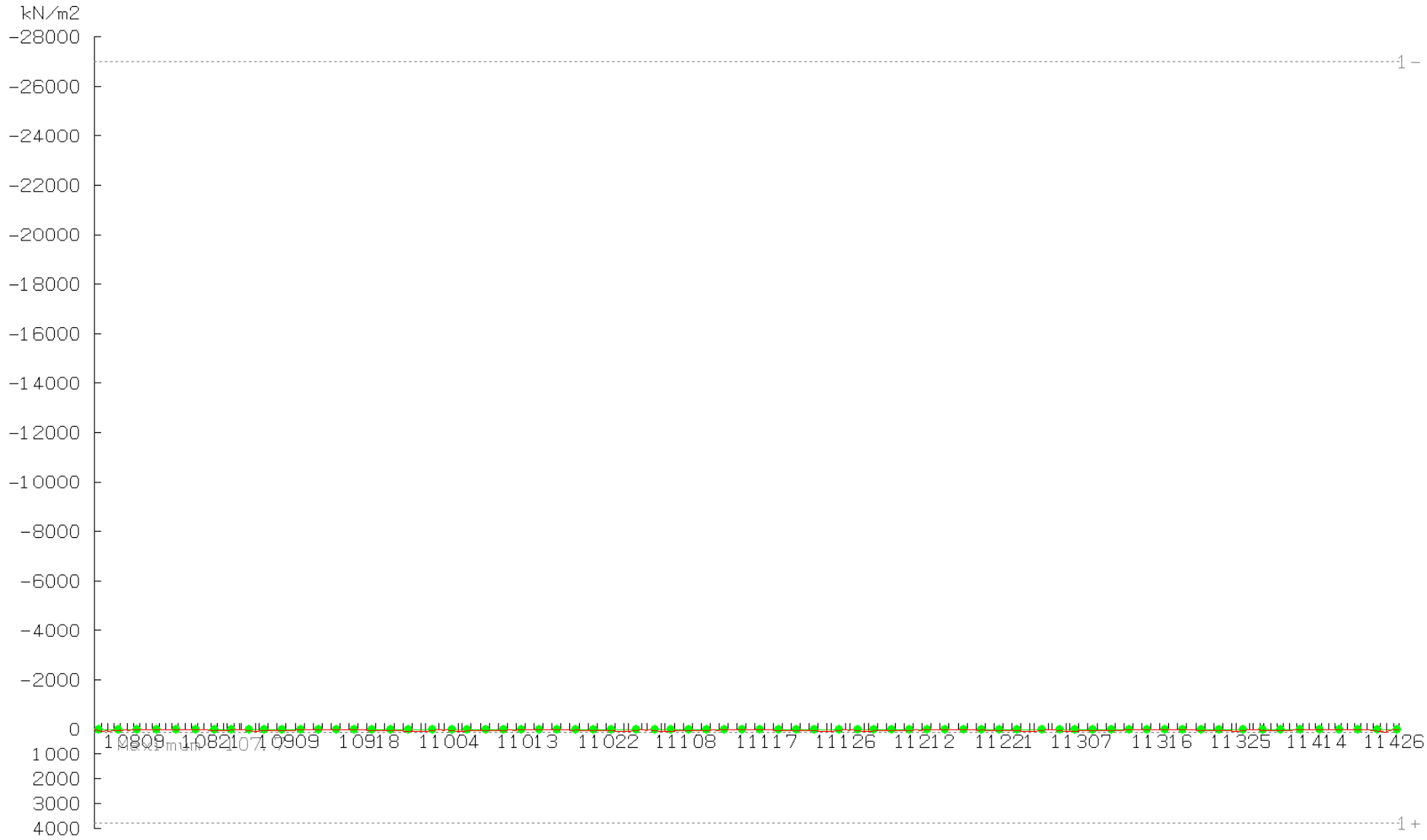
RmSet: 05-G1-Princ, Stage: A5-principal

(DefaultSchedule)/A5-princ-G1

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 2, Part 2, STRESS, SLS-charac.sup

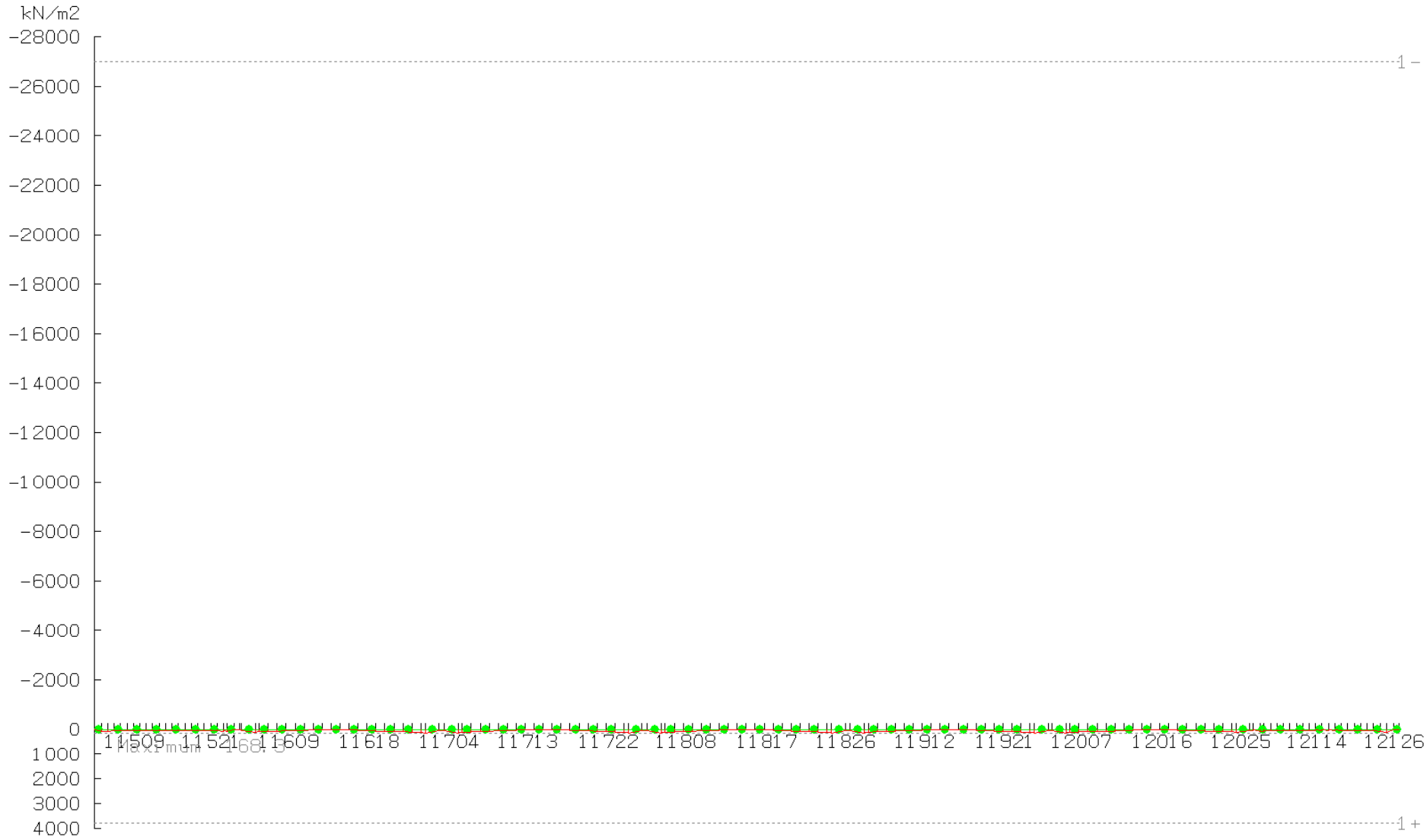
RmSet: 05-G2-Princ, Stage: A5-principal

(DefaultSchedule)/A5-princ-G2

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



SLS-charac.sup
Max, sig-I
Stress2: S2-C*y
(11 , 168)

SLS-charac.sup
Min, sig-I
Stress2: S2-C*y
(0.0 , 2.8)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 3, Part 2, STRESS, SLS-charac.sup

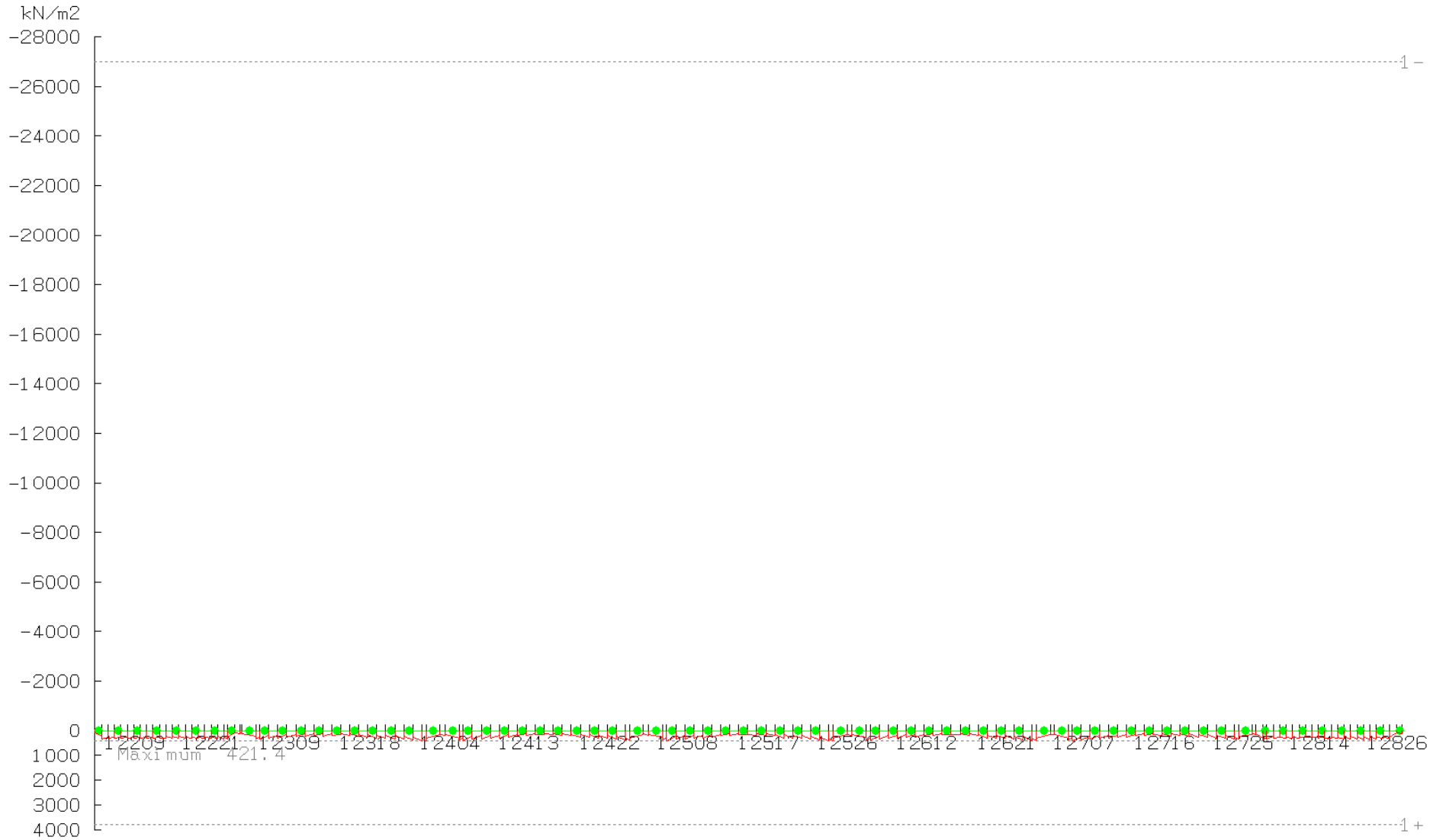
RmSet: 05-G3-Princ, Stage: A5-principal

(DefaultSchedule)/A5-princ-G3

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



SLS-charac.sup
Max, sig-I
Stress2: S2-C*y
(74 , 421)

SLS-charac.sup
Min, sig-I
Stress2: S2-C*y
(0.0 , 3.0)

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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 4, Part 2, STRESS, SLS-charac.sup

RmSet: 05-G4-Princ, Stage: A5-principal

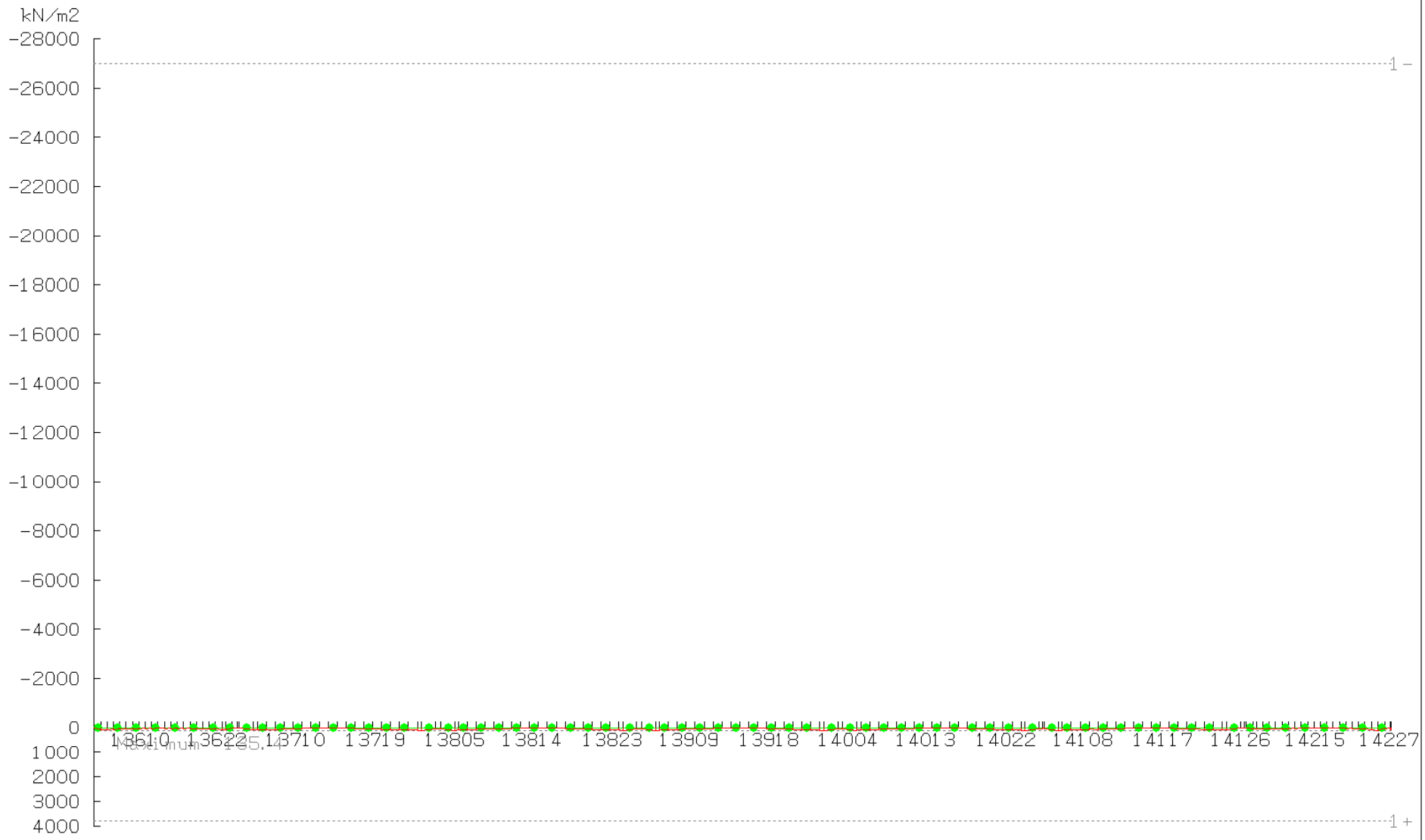
(DefaultSchedule)/A5-princ-G4

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50

kN/m2
-28000
-26000
-24000
-22000
-20000
-18000
-16000
-14000
-12000
-10000
-8000
-6000
-4000
-2000
0
1000
2000
3000
4000
1
1
12910 12922 13010 13019 13105 13114 13123 13209 13218 13304 13313 13322 13408 13417 13426 13515 13527
Maximum -125.7
SLS-charac.sup
Max, sig-I
Stress2: S2-C*y
(8 , 136)
SLS-charac.sup
Min, sig-I
Stress2: S2-C*y
(0.0 , 66.6)



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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 6, Part 2, STRESS, SLS-charac.sup

RmSet: 05-G6-Princ, Stage: A5-principal

(DefaultSchedule)/A5-princ-G6

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50

SLS-charac.sup
Max, sig-I
Stress2: S2-C*y
(75 , 422)

SLS-charac.sup
Min, sig-I
Stress2: S2-C*y
(0.0 , 3.0)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 7, Part 2, STRESS, SLS-charac.sup

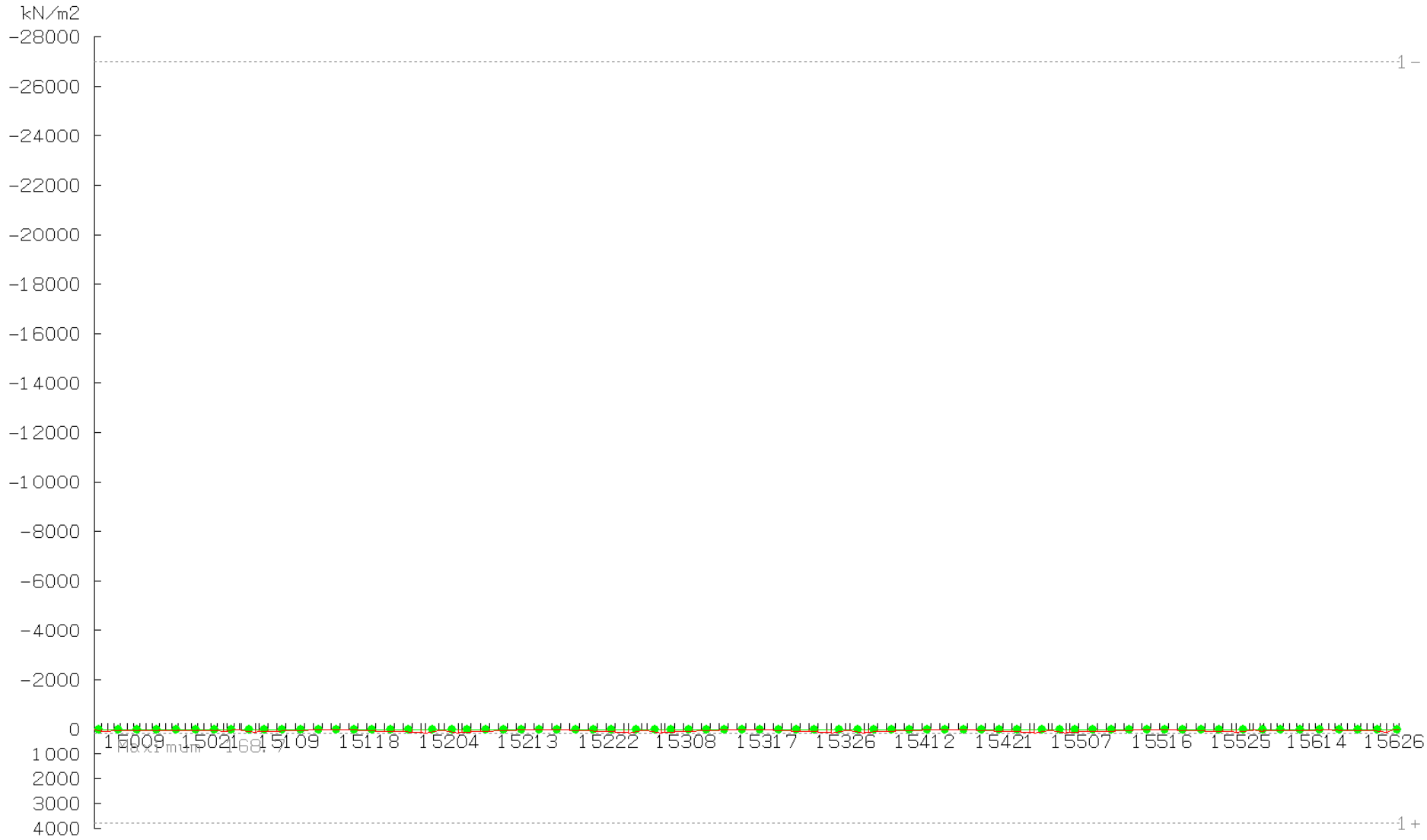
RmSet: 05-G7-Princ, Stage: A5-principal

(DefaultSchedule)/A5-princ-G7

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



SLS-charac.sup
Max, sig-I
Stress2: S2-C*y
(11 , 169)

SLS-charac.sup
Min, sig-I
Stress2: S2-C*y
(0.0 , 2.1)

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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 8, Part 2, STRESS, SLS-charac.sup

RmSet: 05-G8-Princ, Stage: A5-principal

(DefaultSchedule)/A5-princ-G8

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

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10:50

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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 9, Part 2, STRESS, SLS-charac.sup

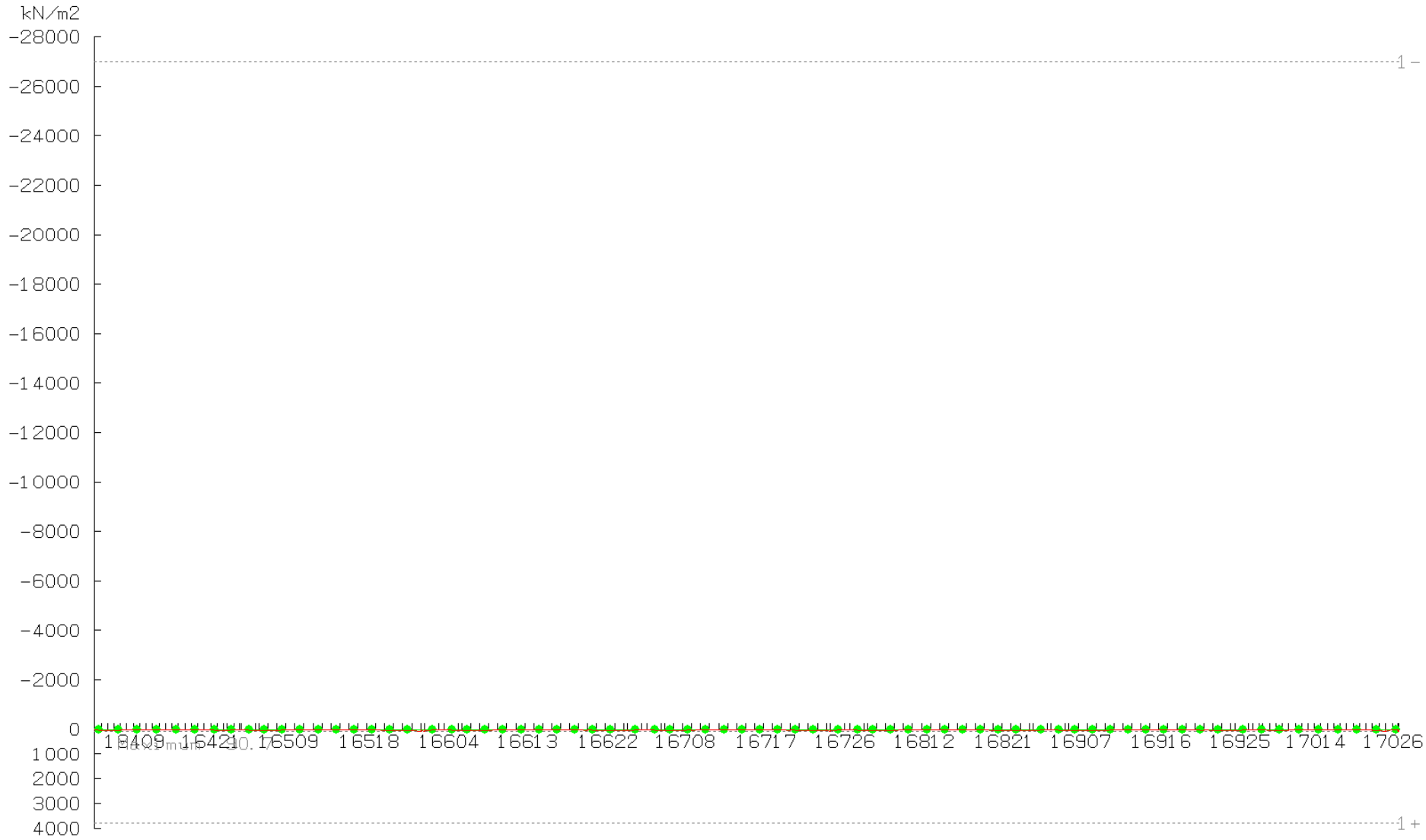
RmSet: 05-G9-Princ, Stage: A5-principal

(DefaultSchedule)/A5-princ-G9

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50



Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 10, Part 2, STRESS, SLS-charac.sup

RmSet: 05-G10-Princ, Stage: A5-principal

(DefaultSchedule)/A5-princ-G10

1 cm Plot = 2439.6 kN/m2

0 2439.6 4879.2 7318.8 9758.4 12198.0

19/07/2021
10:50

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4.4.2.7 Напони у преднапрегнутом челику

Stresses in prestressing steel

Контрола у преднапрегнутом челику/Prestressing steel stresses						
SLS-charac - σp ≤ 0.75*fpk						
fpk=	1860	MPa	→	0.75*fpk	1395	MPa

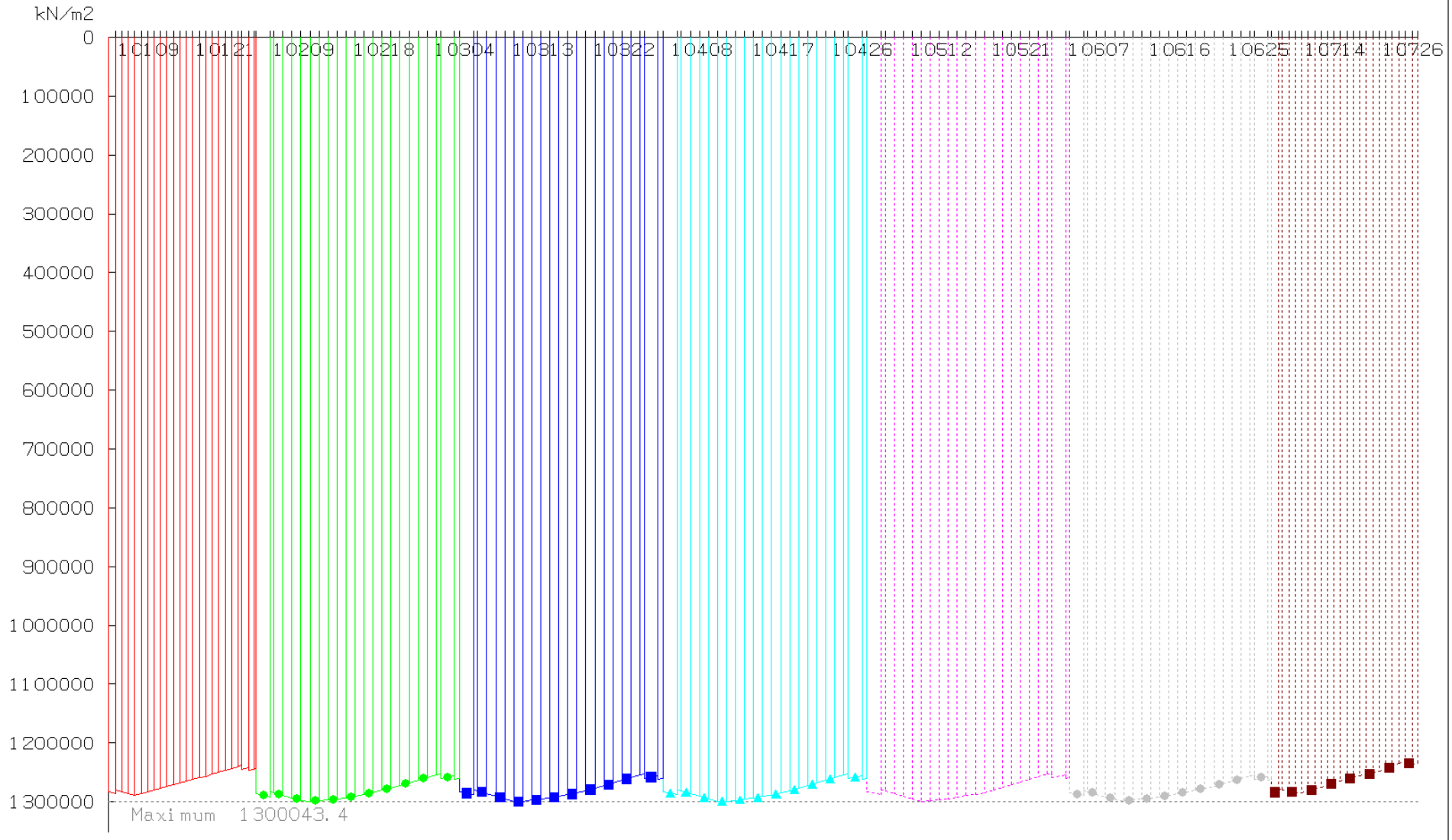
Сумирани приказ карактеристичних комбинација које улазе у анвелопу за проверу граничног стања употребљивости (SLS-characteristic)/

Characteristic combinations for SLS check**:**

rule	Load Case	Stages			SLS												
		Comb 01	Comb 02	Comb 03	Comb 04	Comb 05	Comb 06	Comb 07	Comb 08	Comb 09	Comb 10	Comb 11	Comb 12	Comb 13	Comb 14	Comb 15	Comb 16
		Construction stage			characteristic												
		Girders	STG1	Final	gr1					gr1		gr1				gr2	
Add	SUM-SW			1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Add	SUM-PT			1/1	1/1	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10
Add	SDL			1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Add	CS			1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Add	CSinf			1/1			1/1		1/1		1/1		1/1		1/1		1/1
And	Csinf				1												
And	LM1-TS				1	1	1	1	1	0.75	0.75	0.75	0.75			0.75	0.75
And	LM1-UDL				1	1	1	1	1	0.40	0.40	0.40	0.40			0.40	0.40
And	Pedestrian Load 3kN/m^2				1	1	1	1	1	0.40	0.40	0.40	0.40			0.40	0.40
And	Traction and breaking															1	1
And	FLM3																
And	Wind without traffic													1	1		
And	Wind with traffic							0.60	0.60			1	1				
And	Thermal				0.60	0.60	0.60			1	1					0.60	0.60

Rule –

правило додавања оптерећења, безусловно или само за повољно дејство. Скупљање и течење се узима у оба случаја, као безусловно и као повољно дејство. Безусловно је са rule-add, повољно је са rule-and. / rule for adding loads into combinations, unconditionally ot only favoruable case. Creep and shrinkage is taken double, one combination is with unconditional case and other only for favourable effect.



Comb04.sup
Max
111
(1238151 , 1289493)

Comb04.sup
Max
211
(1252456 , 1299262)

Comb04.sup
Max
311
(1252483 , 1299731)

Comb04.sup
Max
411
(1252438 , 1300043)

Comb04.sup
Max
511
(1250747 , 1299479)

Comb04.sup
Max
611
(1253852 , 1298567)

Comb04.sup
Max
711
(1229999 , 1285131)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 1, Part 2, STRESS, SLS-charac.sup

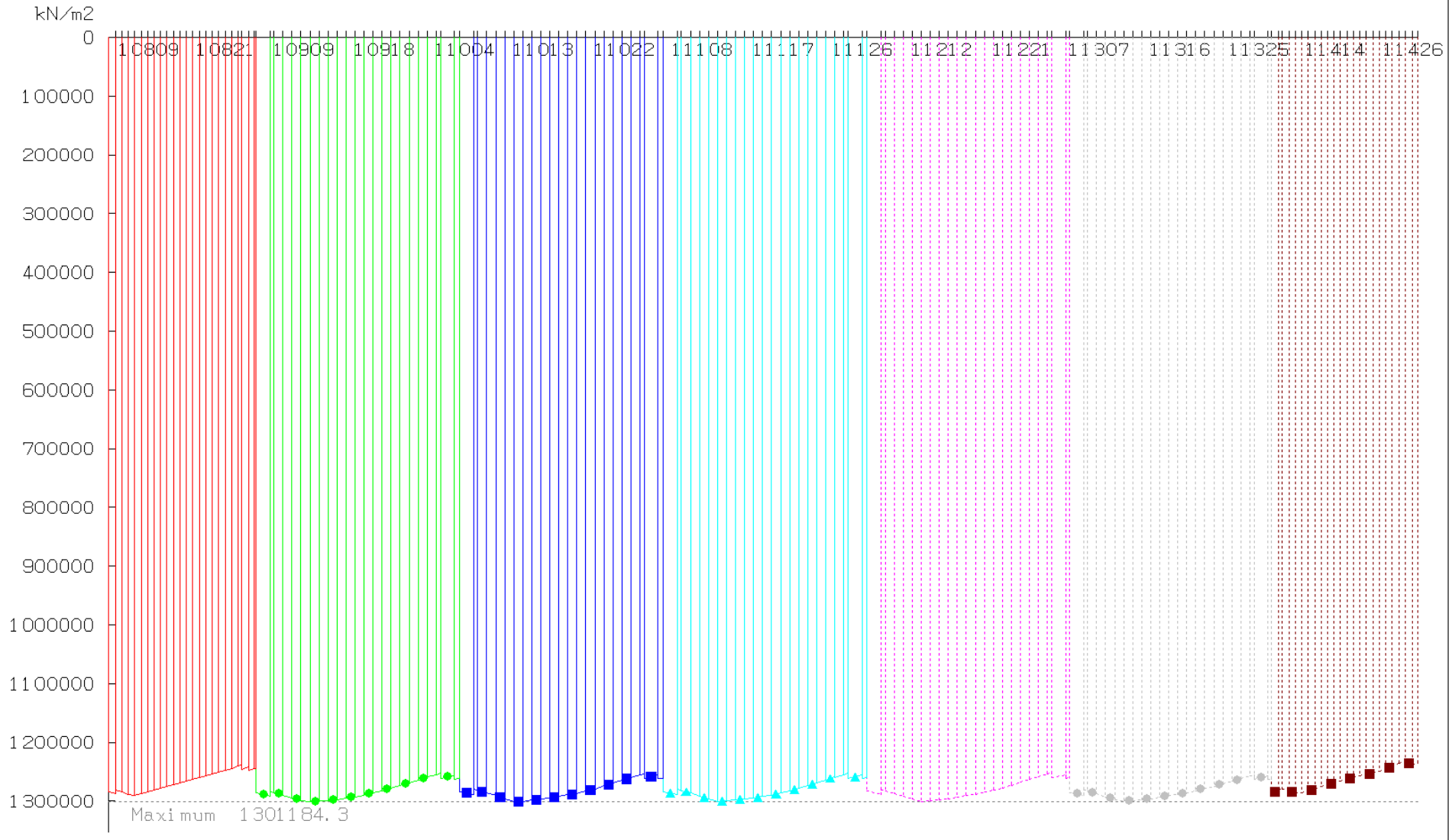
RmSet: 06-G1-Prestress, Stage: A6-prestress

(DefaultSchedule)/A6-prestress-G1

1 cm Plot = 102973.7 kN/m2

0 102973.7 205947.5 308921.2 411894.9 514868.7

19/07/2021
10:50



Comb04.sup
Max
121
(1239008 , 1290686)

Comb04.sup
Max
221
(1252739 , 1300566)

Comb04.sup
Max
321
(1253397 , 1301184)

Comb04.sup
Max
421
(1252767 , 1300634)

Comb04.sup
Max
521
(1251309 , 1300961)

Comb04.sup
Max
621
(1254811 , 1299800)

Comb04.sup
Max
721
(1231331 , 1285922)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 2, Part 2, STRESS, SLS-charac.sup

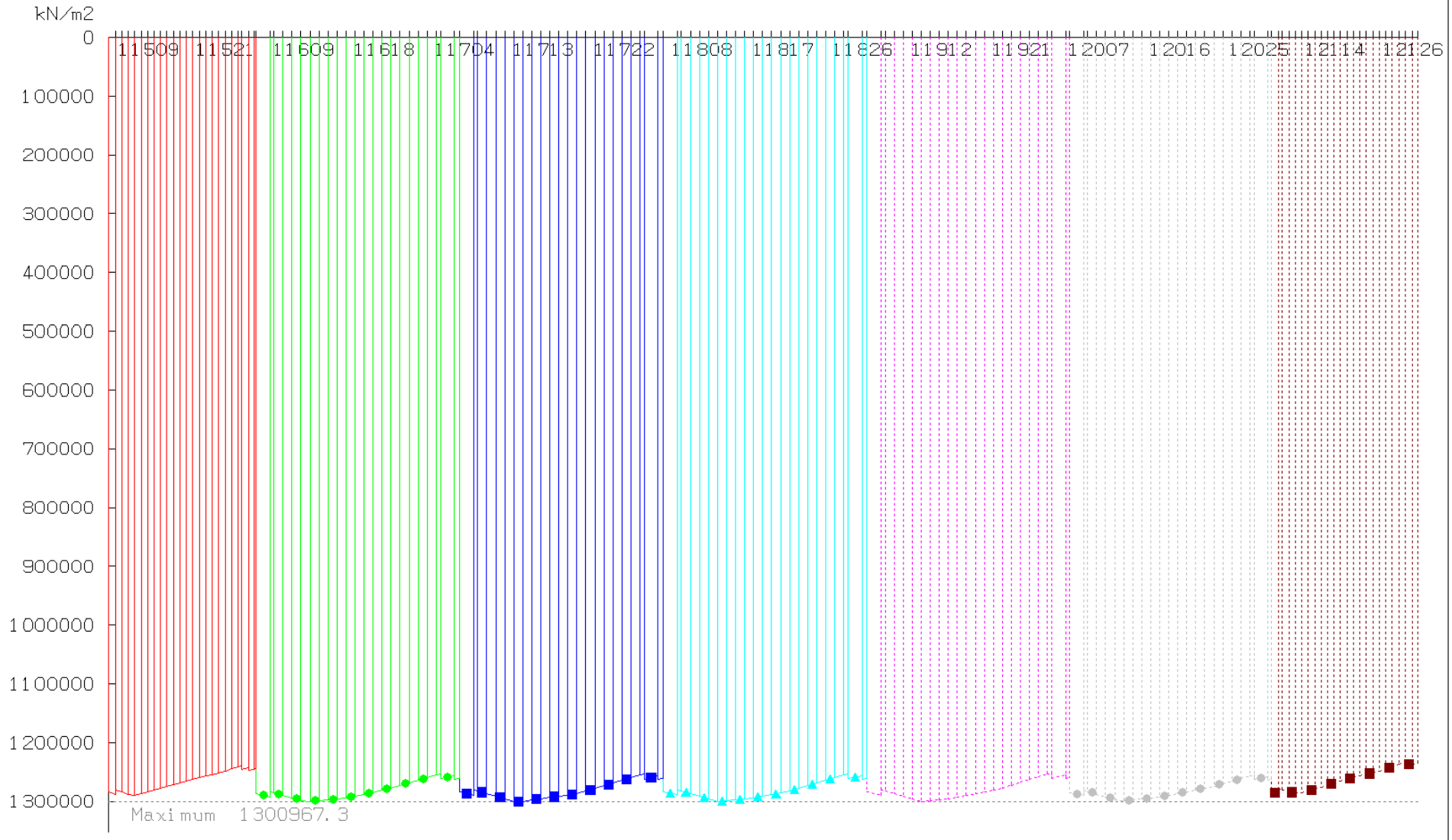
RmSet: 06-G2-Prestress, Stage: A6-prestress

(DefaultSchedule)/A6-prestress-G2

1 cm Plot = 103064.1 kN/m2

0 103064.1 206128.2 309192.3 412256.4 515320.5

19/07/2021
10:50



Comb04.sup
Max
131
(1239561 , 1290626)

Comb04.sup
Max
231
(1253286 , 1300122)

Comb04.sup
Max
331
(1253913 , 1300967)

Comb04.sup
Max
431
(1253283 , 1300162)

Comb04.sup
Max
531
(1252448 , 1300492)

Comb04.sup
Max
631
(1254962 , 1299419)

Comb04.sup
Max
731
(1231762 , 1286421)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 3, Part 2, STRESS, SLS-charac.sup

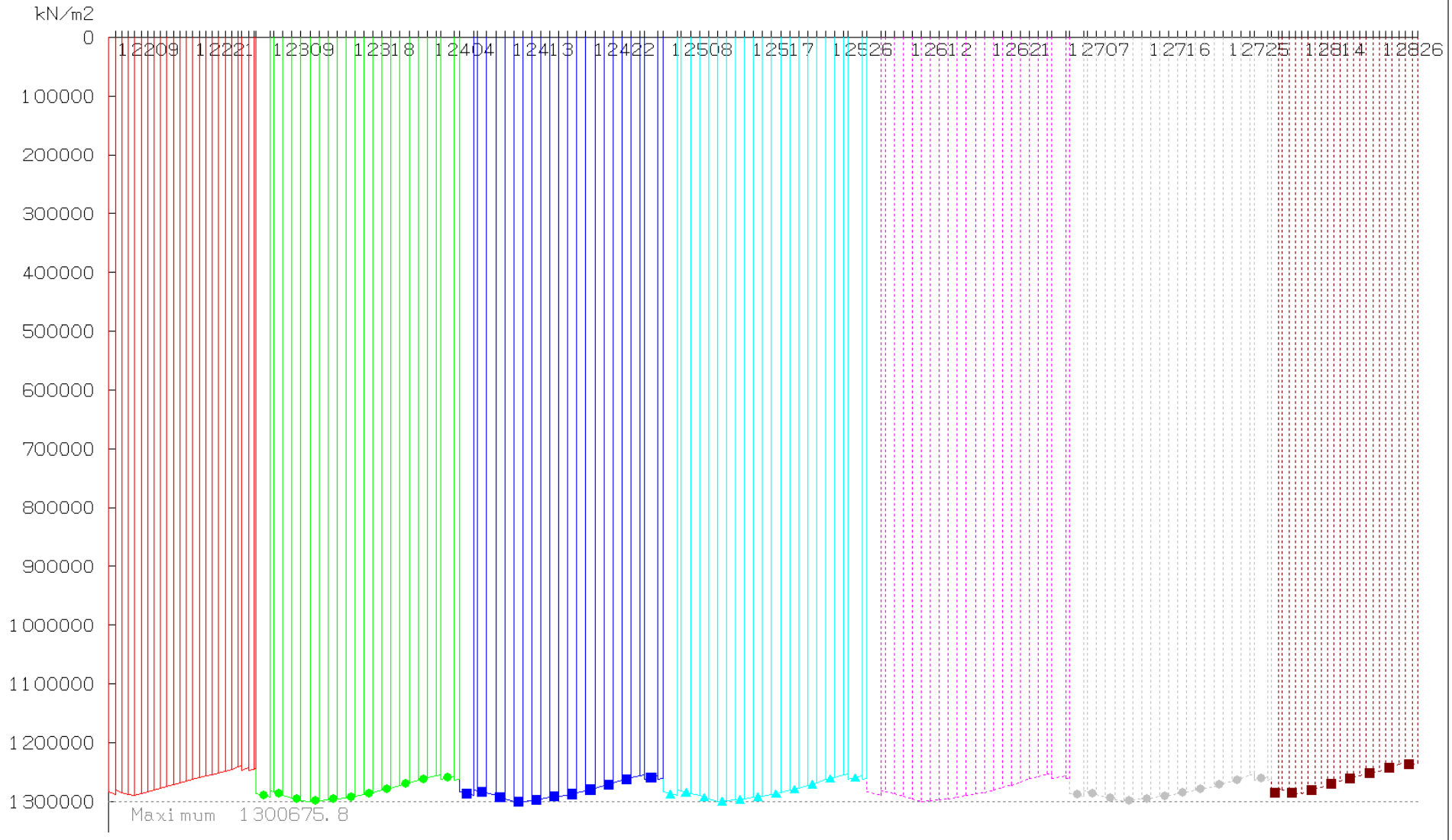
RmSet: 06-G3-Prestress, Stage: A6-prestress

(DefaultSchedule)/A6-prestress-G3

1 cm Plot = 103046.9 kN/m2

0 103046.9 206093.8 309140.7 412187.6 515234.6

19/07/2021
10:50



Comb04.sup
Max
141
(1239913 , 1290443)

Comb04.sup
Max
241
(1254018 , 1299853)

Comb04.sup
Max
341
(1254260 , 1300676)

Comb04.sup
Max
441
(1253093 , 1299868)

Comb04.sup
Max
541
(1251302 , 1300150)

Comb04.sup
Max
641
(1253376 , 1299134)

Comb04.sup
Max
741
(1231835 , 1286756)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 4, Part 2, STRESS, SLS-charac.sup

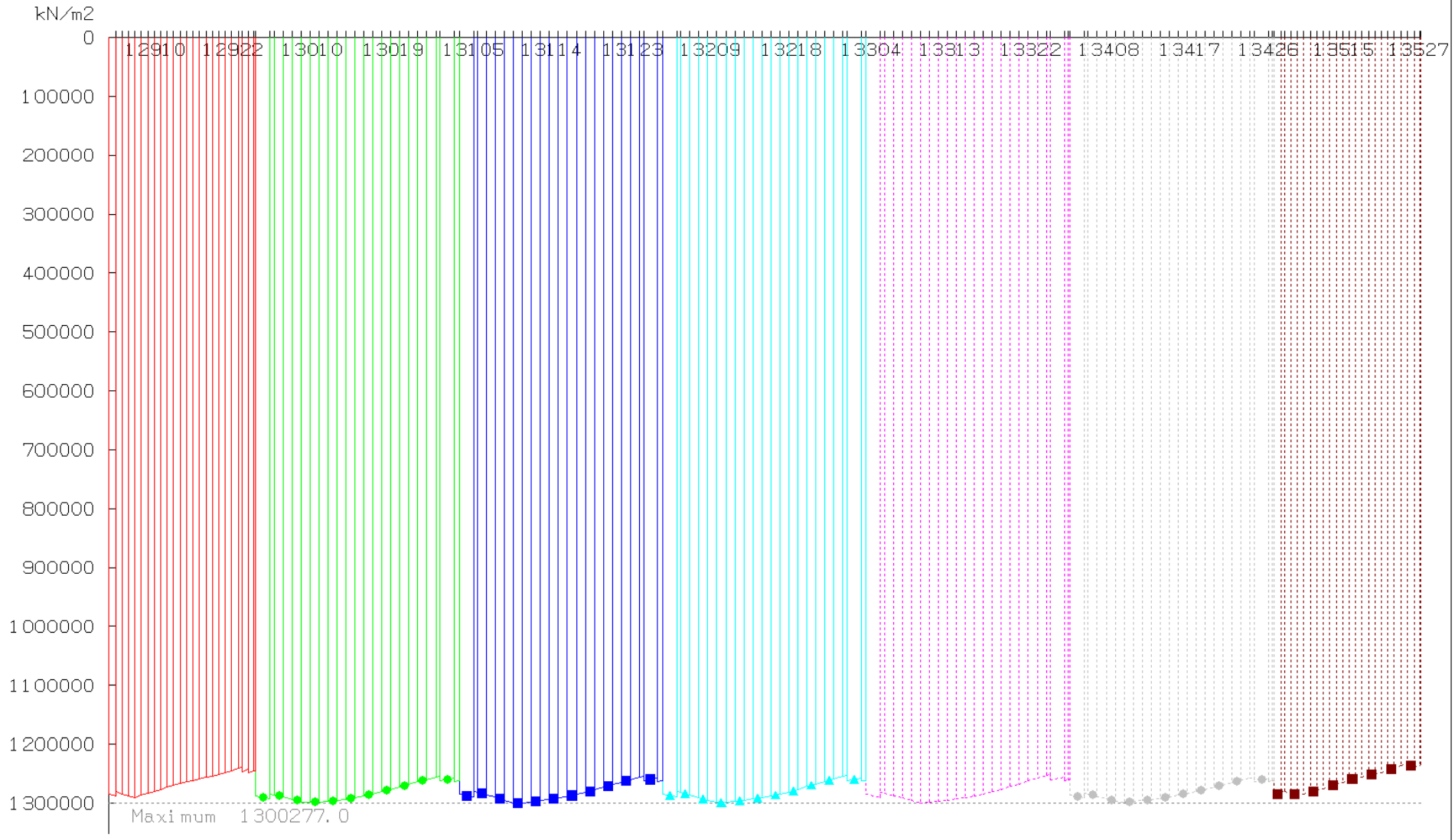
RmSet: 06-G4-Prestress, Stage: A6-prestress

(DefaultSchedule)/A6-prestress-G4

1 cm Plot = 103023.8 kN/m2

0 103023.8 206047.6 309071.5 412095.3 515119.1

19/07/2021
10:50



Comb04.sup
Max
151
(1239683 , 1290149)

Comb04.sup
Max
251
(1254207 , 1299133)

Comb04.sup
Max
351
(1254439 , 1300277)

Comb04.sup
Max
451
(1253274 , 1299164)

Comb04.sup
Max
551
(1251487 , 1300013)

Comb04.sup
Max
651
(1255260 , 1299003)

Comb04.sup
Max
751
(1231758 , 1286552)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 5, Part 2, STRESS, SLS-charac.sup

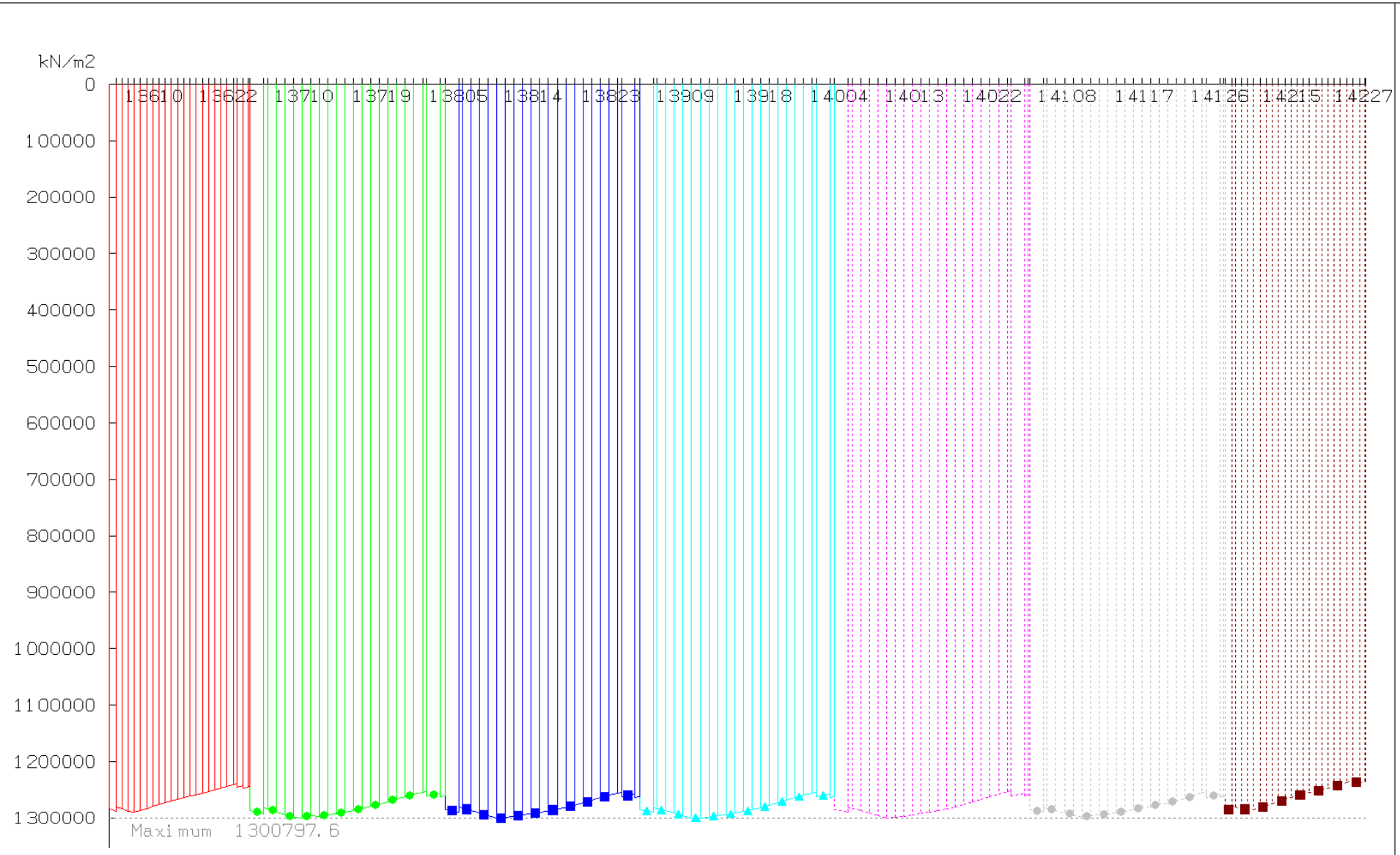
RmSet: 06-G5-Prestress, Stage: A6-prestress

(DefaultSchedule)/A6-prestress-G5

1 cm Plot = 102992.2 kN/m2

0 102992.2 205984.5 308976.7 411969.0 514961.2

19/07/2021
10:50



Comb04.sup
Max
161
(1239703 , 1290322)

Comb04.sup
Max
261
(1253093 , 1299746)

Comb04.sup
Max
361
(1254450 , 1300553)

Comb04.sup
Max
461
(1254400 , 1300798)

Comb04.sup
Max
561
(1251497 , 1300064)

Comb04.sup
Max
661
(1253591 , 1297620)

Comb04.sup
Max
761
(1231421 , 1286572)

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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 6, Part 2, STRESS, SLS-charac.sup

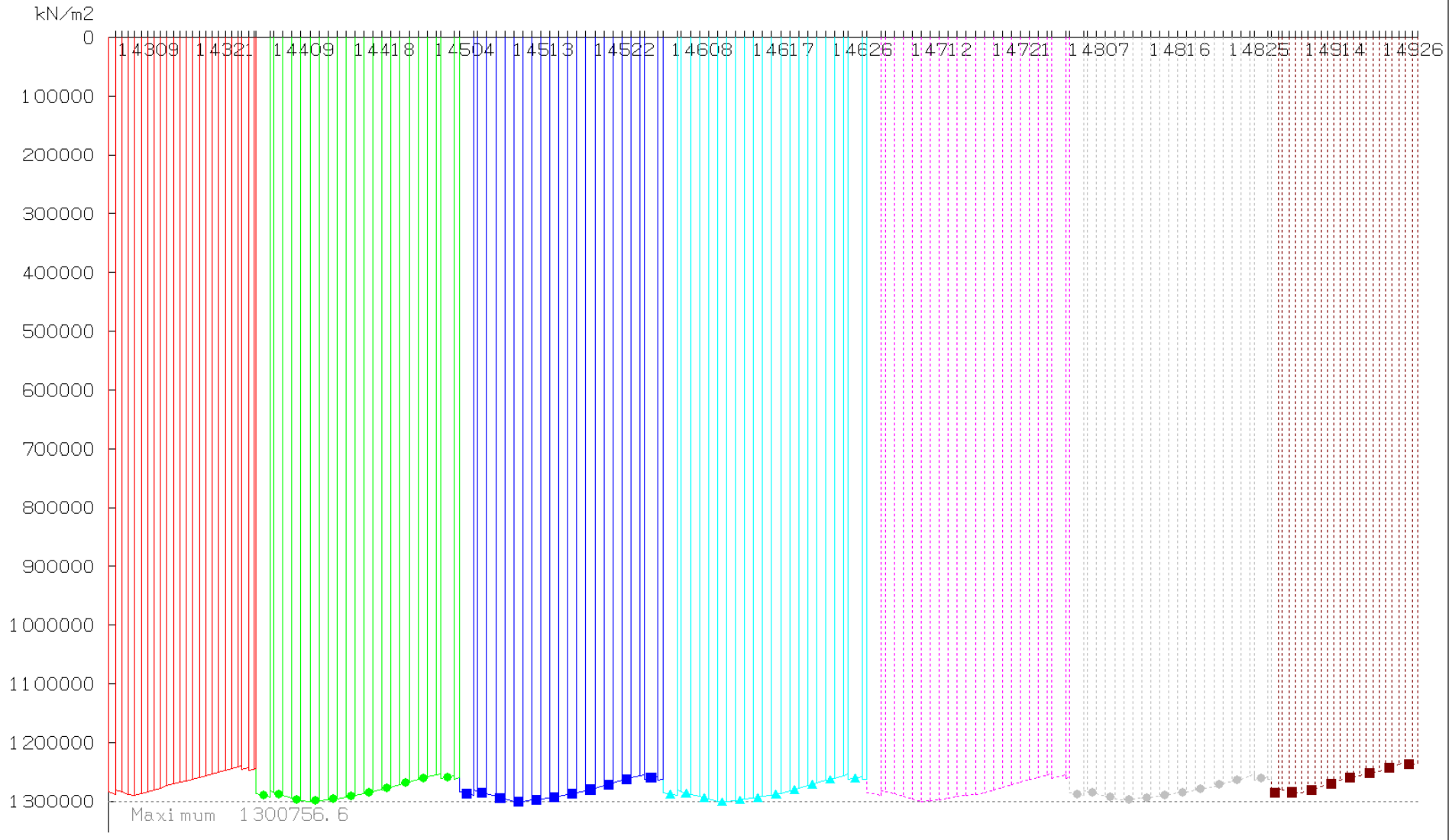
RmSet: 06-G6-Prestress, Stage: A6-prestress

(DefaultSchedule)/A6-prestress-G6

1 cm Plot = 103033.5 kN/m2

0 103033.5 206067.0 309100.4 412133.9 515167.4

19/07/2021
10:50



Comb04.sup
Max
171
(1239596 , 1290454)

Comb04.sup
Max
271
(1252921 , 1299888)

Comb04.sup
Max
371
(1254293 , 1300705)

Comb04.sup
Max
471
(1253124 , 1300757)

Comb04.sup
Max
571
(1251334 , 1300179)

Comb04.sup
Max
671
(1253414 , 1297785)

Comb04.sup
Max
771
(1231811 , 1286465)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 7, Part 2, STRESS, SLS-charac.sup

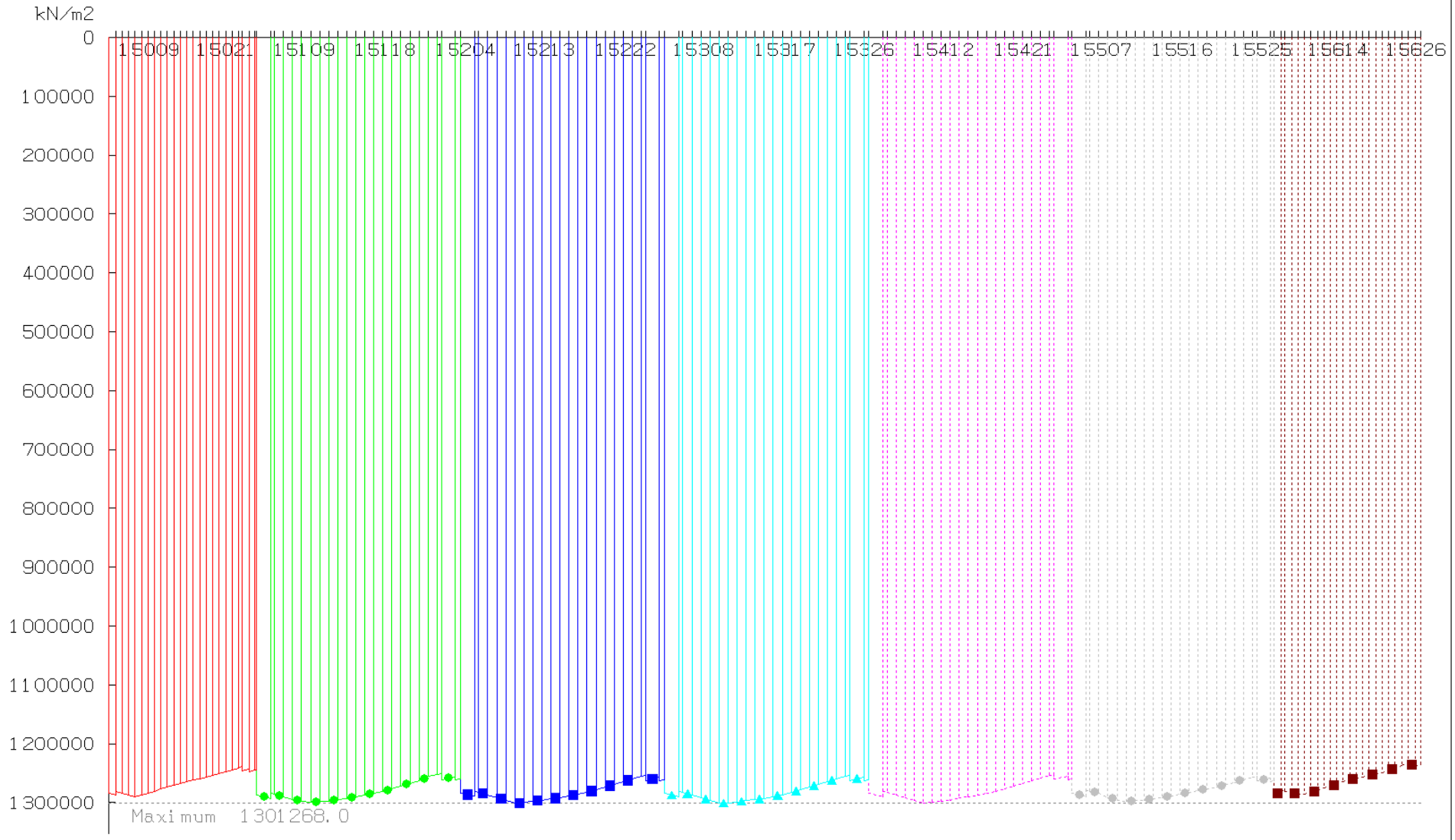
RmSet: 06-G7-Prestress, Stage: A6-prestress

(DefaultSchedule)/A6-prestress-G7

1 cm Plot = 103030.2 kN/m2

0 103030.2 206060.5 309090.7 412120.9 515151.1

19/07/2021
10:50



Comb04.sup
Max
181
(1239291 , 1290495)

Comb04.sup
Max
281
(1250277 , 1299359)

Comb04.sup
Max
381
(1253967 , 1301016)

Comb04.sup
Max
481
(1254103 , 1301268)

Comb04.sup
Max
581
(1251884 , 1300541)

Comb04.sup
Max
681
(1255024 , 1298310)

Comb04.sup
Max
781
(1231727 , 1286170)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 8, Part 2, STRESS, SLS-charac.sup

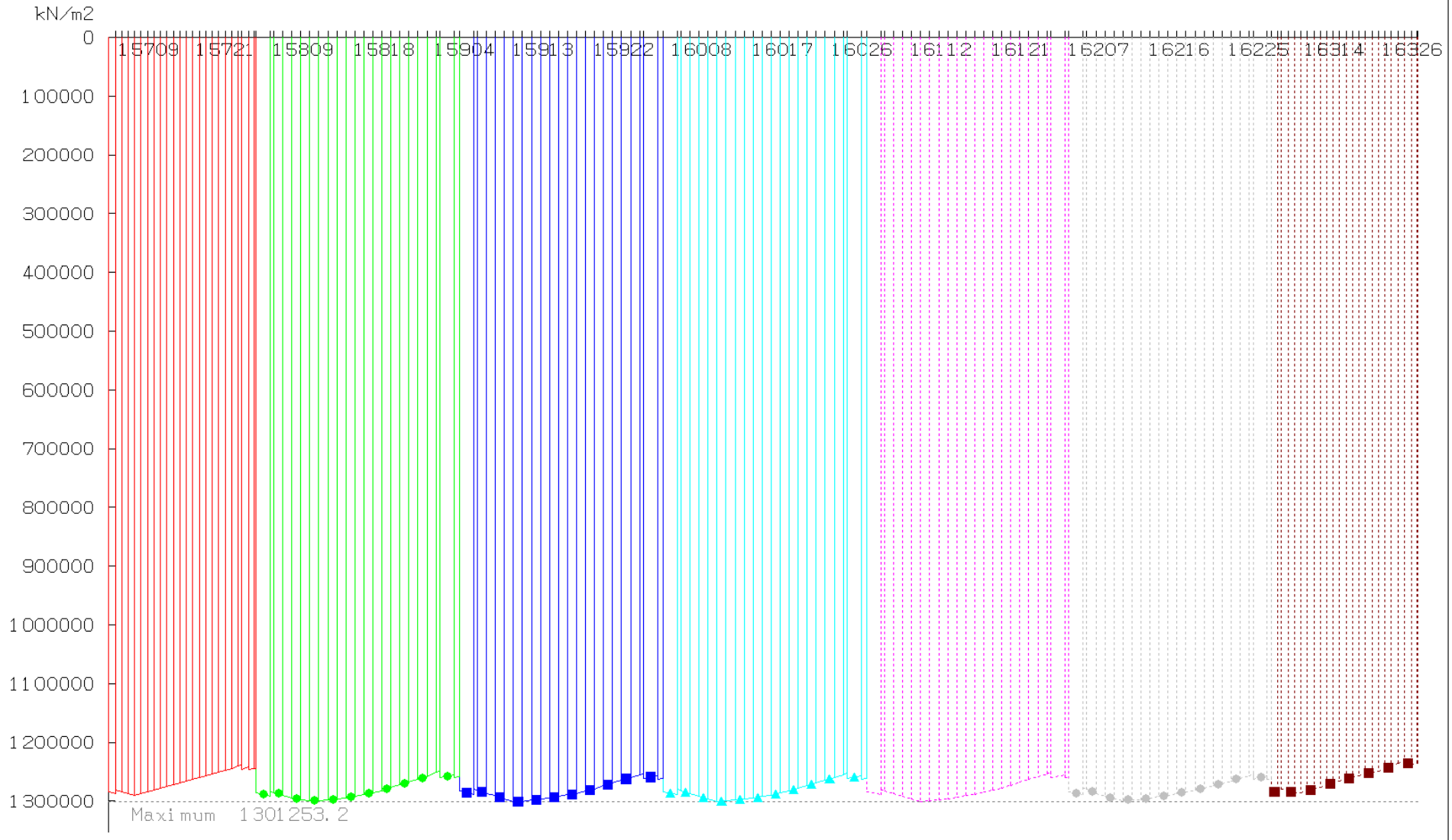
RmSet: 06-G8-Prestress, Stage: A6-prestress

(DefaultSchedule)/A6-prestress-G8

1 cm Plot = 103070.7 kN/m2

0 103070.7 206141.5 309212.2 412282.9 515353.7

19/07/2021
10:50



Comb04.sup
Max
191
(1238782 , 1290322)

Comb04.sup
Max
291
(1249765 , 1299831)

Comb04.sup
Max
391
(1253472 , 1301253)

Comb04.sup
Max
491
(1252836 , 1300697)

Comb04.sup
Max
591
(1251382 , 1301029)

Comb04.sup
Max
691
(1254479 , 1298787)

Comb04.sup
Max
791
(1231268 , 1285721)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 9, Part 2, STRESS, SLS-charac.sup

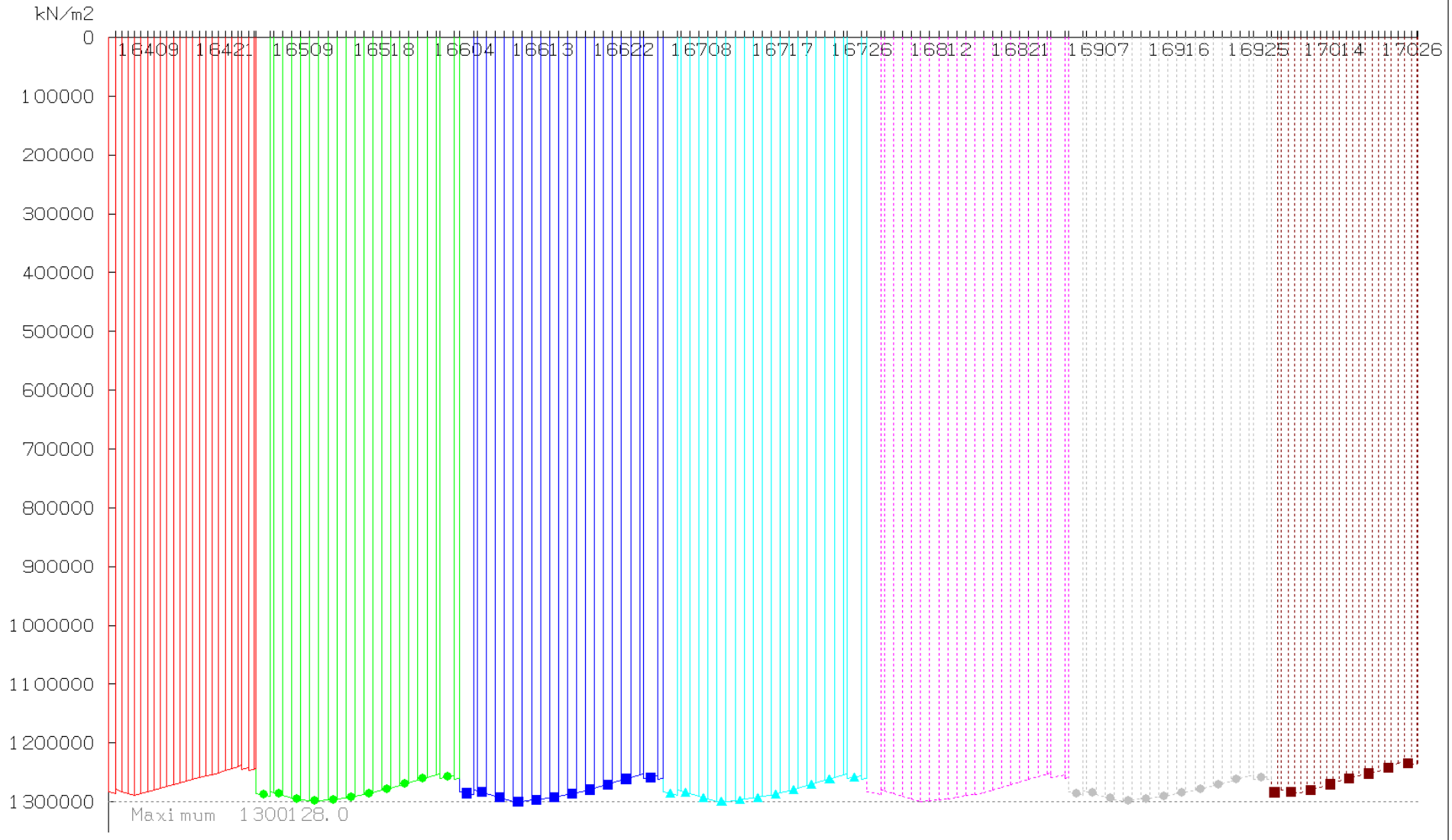
RmSet: 06-G9-Prestress, Stage: A6-prestress

(DefaultSchedule)/A6-prestress-G9

1 cm Plot = 103069.6 kN/m2

0 103069.6 206139.1 309208.7 412278.2 515347.8

19/07/2021
10:50



Comb04.sup
Max
201
(1238191 , 1289312)

Comb04.sup
Max
301
(1252556 , 1298801)

Comb04.sup
Max
401
(1252577 , 1299820)

Comb04.sup
Max
501
(1252707 , 1300128)

Comb04.sup
Max
601
(1250846 , 1299612)

Comb04.sup
Max
701
(1253551 , 1298662)

Comb04.sup
Max
801
(1229770 , 1285003)

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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 10, Part 2, STRESS, SLS-charac.sup

RmSet: 06-G10-Prestress, Stage: A6-prestress

(DefaultSchedule)/A6-prestress-G10

1 cm Plot = 102980.4 kN/m2

0 102980.4 205960.9 308941.3 411921.7 514902.2

19/07/2021
10:50

4.4.2.8 Напони у арматурном челику

Stresses in reinforcing steel

ЛЕГЕНДА /LEGEND:

LongG-B(max/min) - **максимални и минимални напони у арматури у доњој зони** /
Maximum and minimum values in bottom zone bars

LongG-T(max/min) - **максимални и минимални напони у арматури у горњој зони** /
Maximum and minimum values in top zone bars

Контрола напона у арматурном челику/Reinforcement steel stresses						
SLS-charac - σs ≤ 0.8*fyk = 400 MPa						
fyk=	500	MPa	→	0.8*fyk=	400	MPa

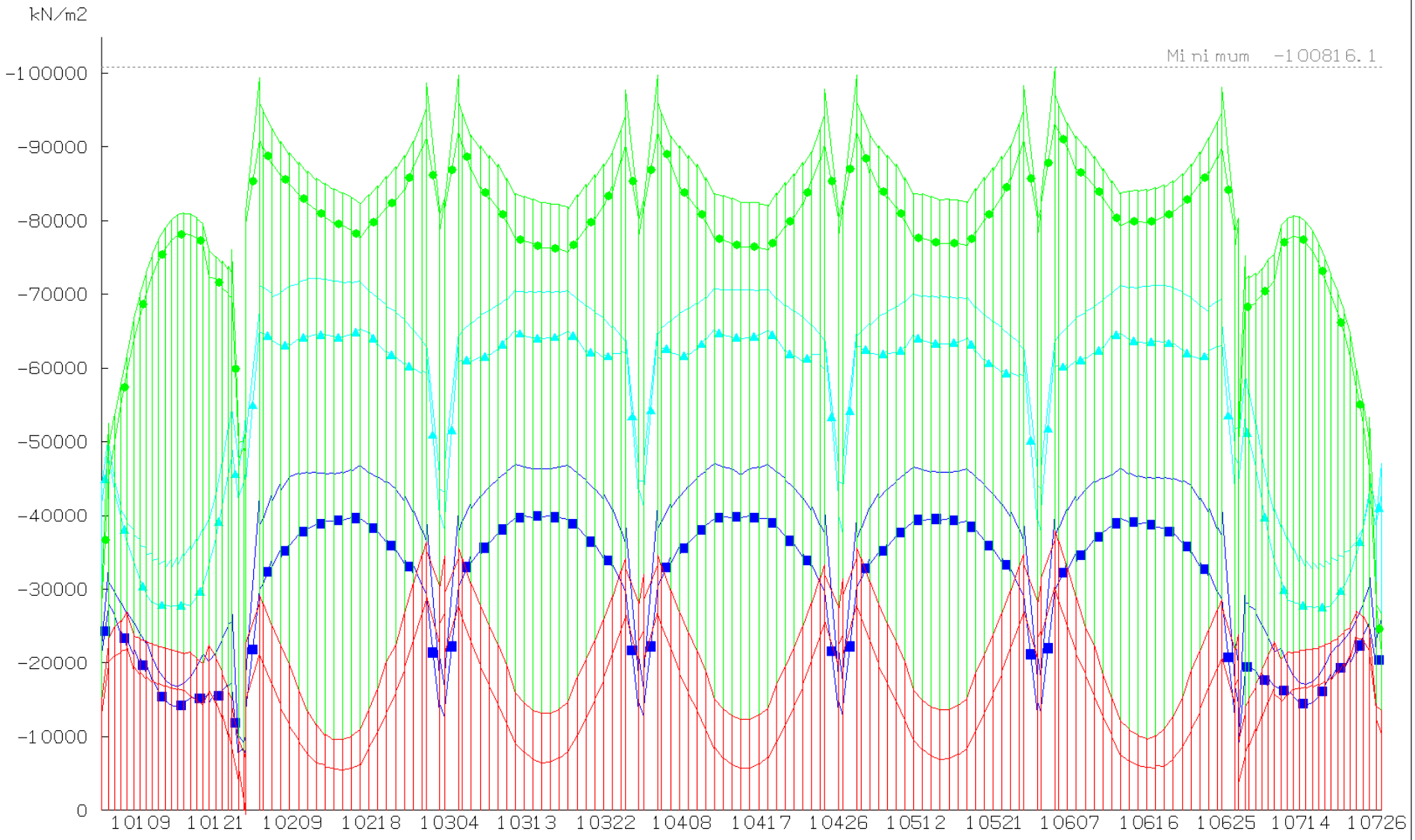
Сумирани приказ карактеристичних комбинација које улазе у анвелопу за проверу граничног стања употребљивости (SLS-characteristic)/

Characteristic combinations for SLS check**:**

rule	Load Case	Stages			SLS												
		Comb 01	Comb 02	Comb 03	Comb 04	Comb 05	Comb 06	Comb 07	Comb 08	Comb 09	Comb 10	Comb 11	Comb 12	Comb 13	Comb 14	Comb 15	Comb 16
		Construction stage			characteristic												
		Girders	STG1	Final	gr1					gr1		gr1				gr2	
Add	SUM-SW			1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Add	SUM-PT			1/1	1/1	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10	0.90/1.10
Add	SDL			1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Add	CS			1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Add	CSinf			1/1			1/1		1/1		1/1		1/1		1/1		1/1
And	Csinf				1												
And	LM1-TS				1	1	1	1	1	0.75	0.75	0.75	0.75			0.75	0.75
And	LM1-UDL				1	1	1	1	1	0.40	0.40	0.40	0.40			0.40	0.40
And	Pedestrian Load 3kN/m^2				1	1	1	1	1	0.40	0.40	0.40	0.40			0.40	0.40
And	Traction and breaking															1	1
And	FLM3																
And	Wind without traffic													1	1		
And	Wind with traffic							0.60	0.60			1	1				
And	Thermal				0.60	0.60	0.60			1	1					0.60	0.60

Rule –

правило додавања оптерећења, безусловно или само за повољно дејство. Скупљање и течење се узима у оба случаја, као безусловно и као повољно дејство. Безусловно је са rule-add, повољно је са rule-and. / rule for adding loads into combinations, unconditionally ot only favoruable case. Creep and shrinkage is taken double, one combination is with unconditional case and other only for favourable effect.



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 1, Part 2, STRESS, SLS-charac.sup

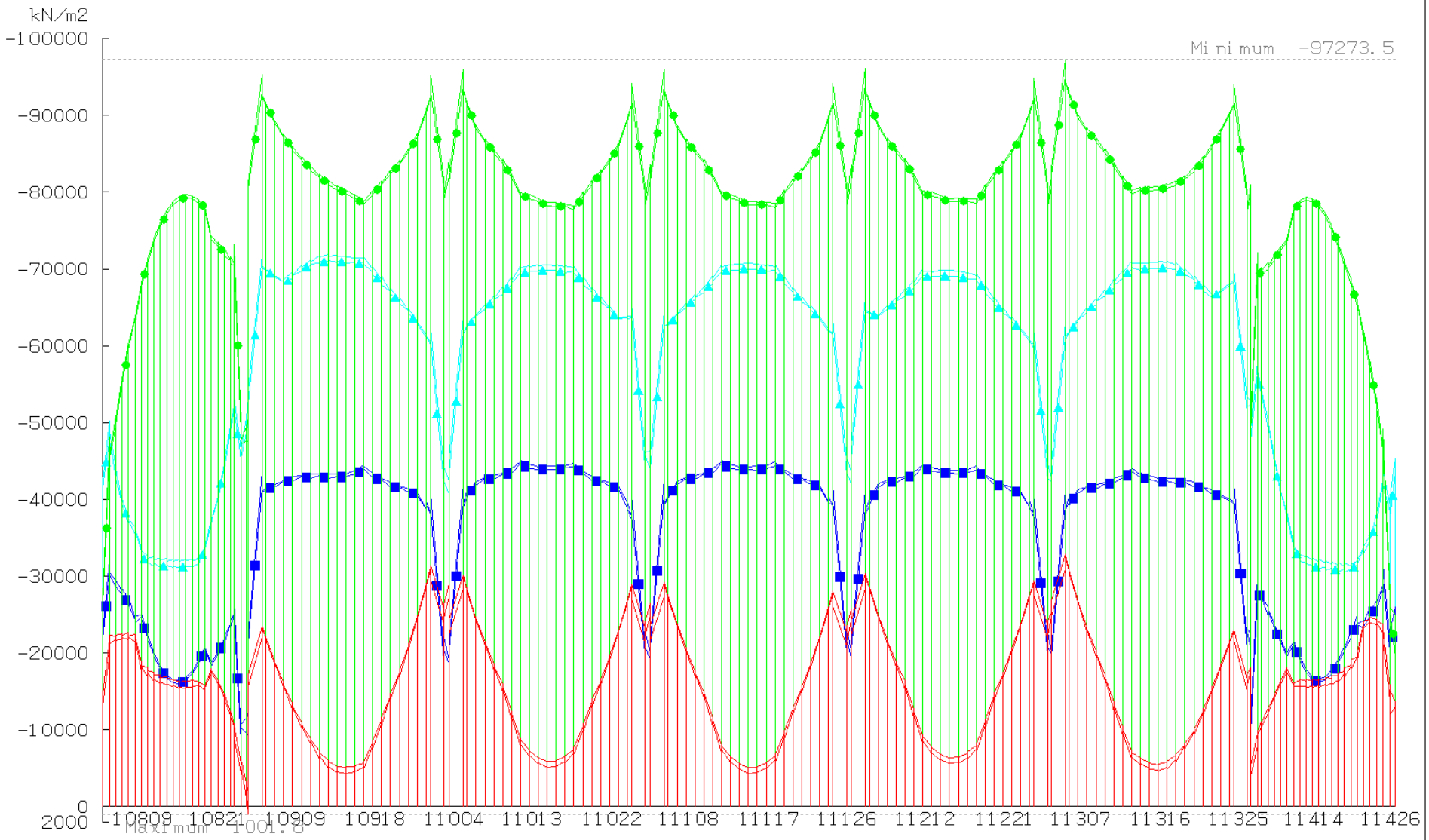
RmSet: 07-G1-Reinf, Stage: A7-reinf-stress

(DefaultSchedule)/A7-reinf-G1

1 cm Plot = 8031.3 kN/m2

0 8031.3 16062.5 24093.8 32125.1 40156.3

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 2, Part 2, STRESS, SLS-charac.sup

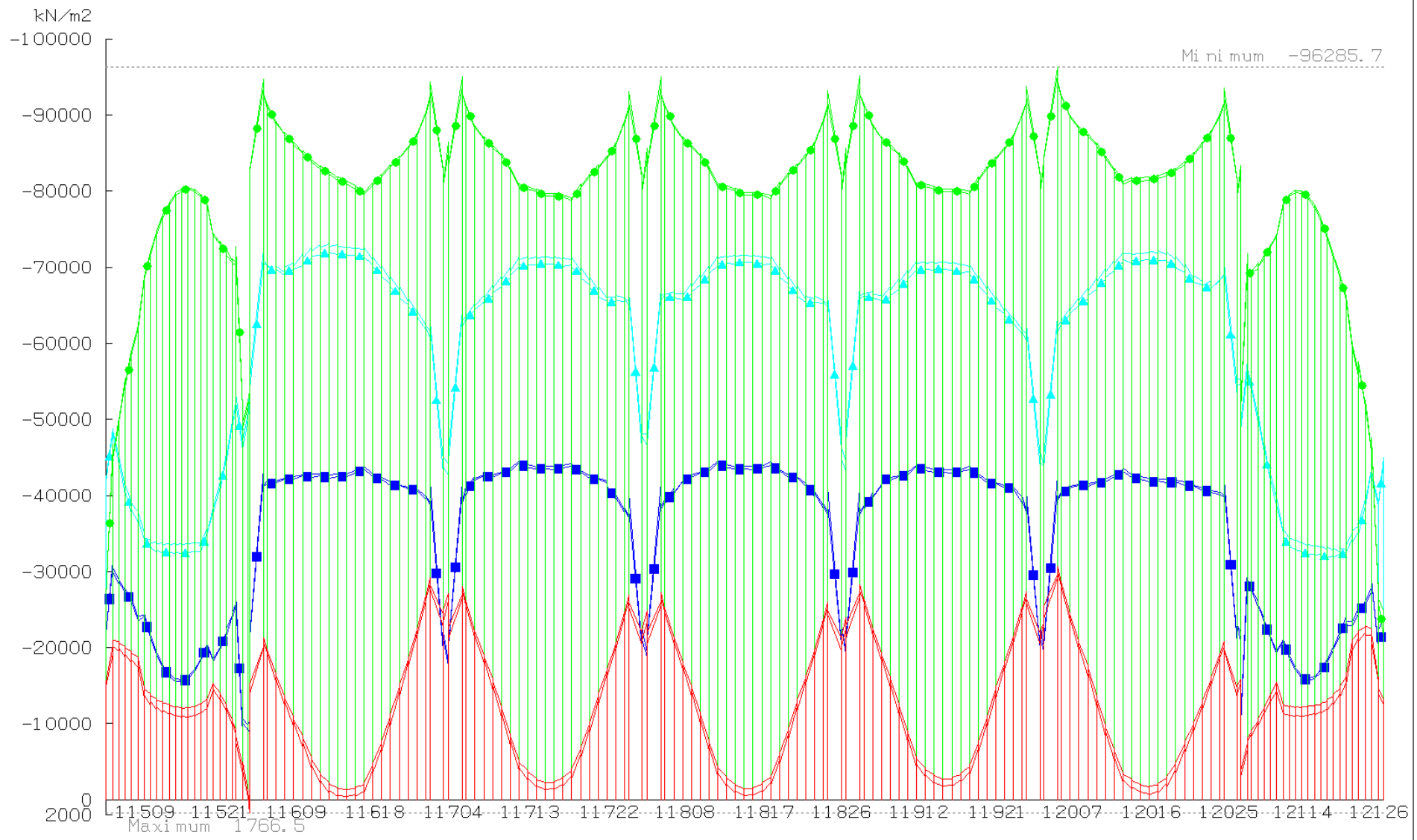
RmSet: 07-G2-Reinf, Stage: A7-reinf-stress

(DefaultSchedule)/A7-reinf-G2

1 cm Plot = 7784.2 kN/m2

0 7784.2 15568.4 23352.5 31136.7 38920.9

19/07/2021
10:50



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Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 3, Part 2, STRESS, SLS-charac. sup

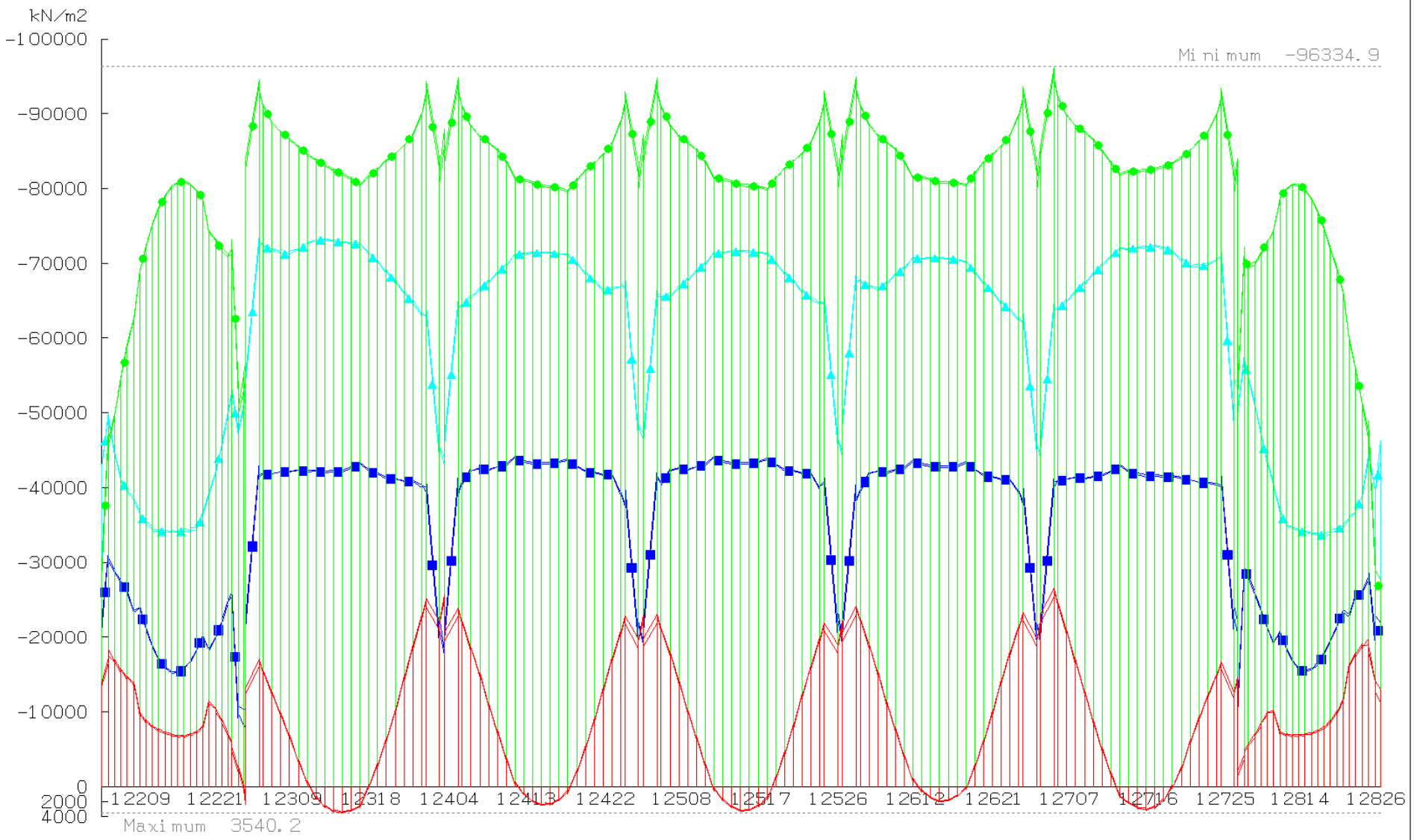
RmSet: 07-G3-Reinf, Stage: A7-reinf-stress

(DefaultSchedule)/A7-reinf-G3

1 cm Plot = 7766.5 kN/m2

0 7766.5 15533.0 23299.5 31066.0 38832.5

19/07/2021
10:50



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Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 4, Part 2, STRESS, SLS-charac.sup

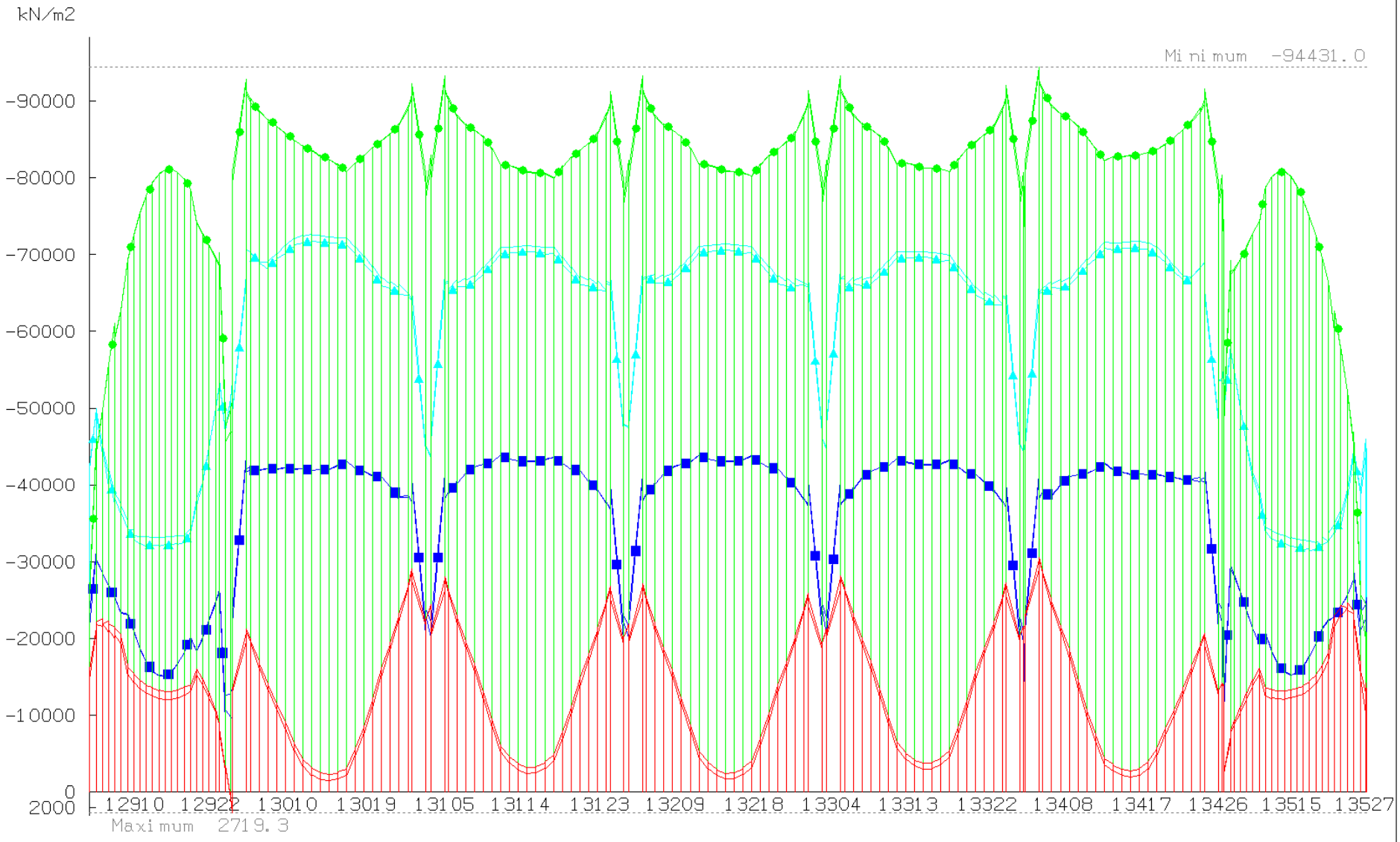
RmSet: 07-G4-Reinf, Stage: A7-reinf-stress

(DefaultSchedule)/A7-reinf-G4

1 cm Plot = 7910.9 kN/m2

0 7910.9 15821.8 23732.7 31643.6 39554.5

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
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Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 5, Part 2, STRESS, SLS-charac.sup

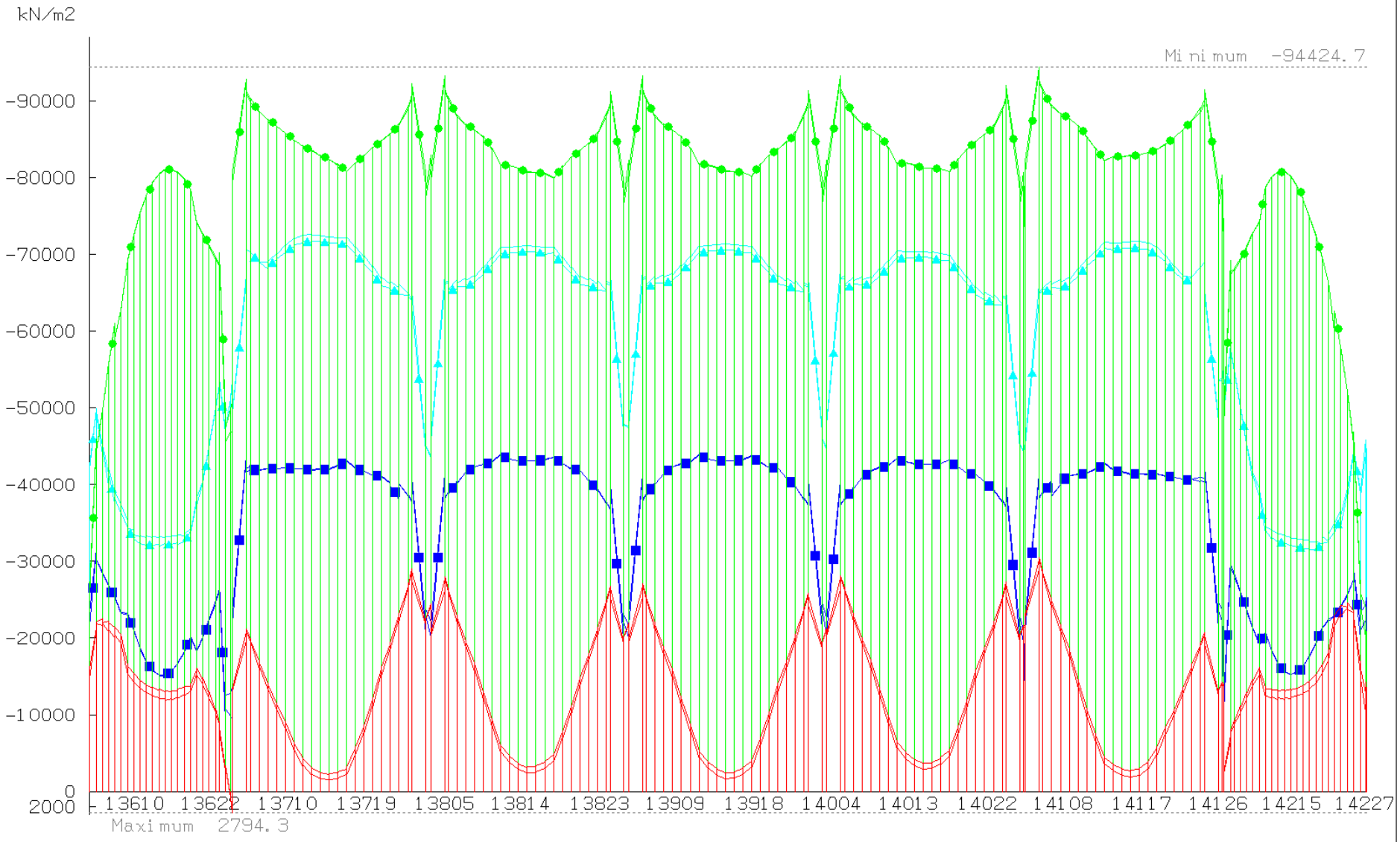
RmSet: 07-G5-Reinf, Stage: A7-reinf-stress

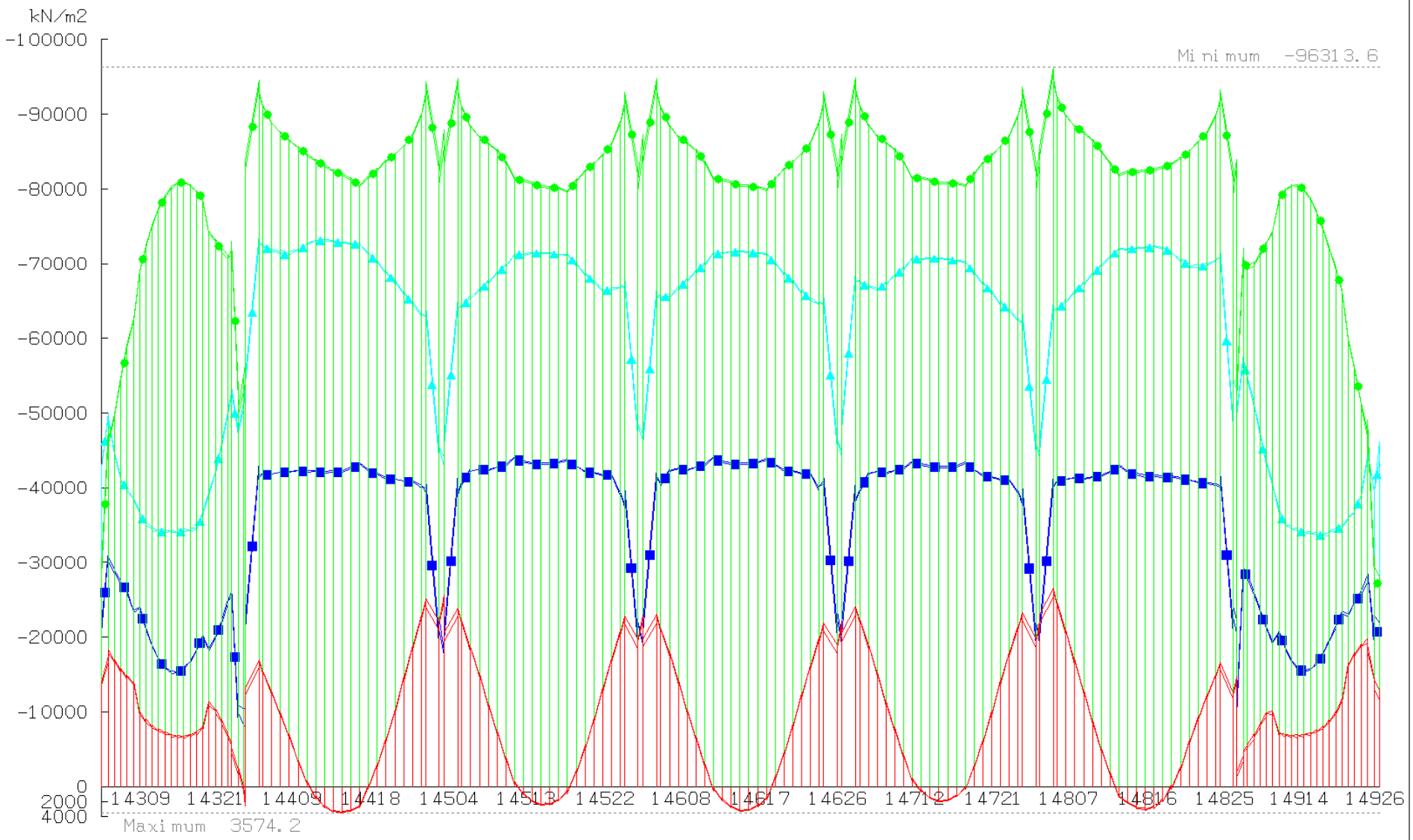
(DefaultSchedule)/A7-reinf-G5

1 cm Plot = 7695.1 kN/m2

0 7695.1 15390.2 23085.2 30780.3 38475.4

19/07/2021
10:50


kN/m2
Minimum -94424.7
-90000
-80000
-70000
-60000
-50000
-40000
-30000
-20000
-10000
0
2000
13610
13622
13710
13719
13805
13814
13823
13909
13918
14004
14013
14022
14108
14117
14126
14215
14227
Maximum 2794.3
SLS-charac. sup Max LongG-B (-30533 , 2794)
SLS-charac. sup Min LongG-B (-94425 , -20130)
SLS-charac. sup Max LongG-T (-43972 , -9147)
SLS-charac. sup Min LongG-T (-72639 , -31473)



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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 7, Part 2, STRESS, SLS-charac.sup

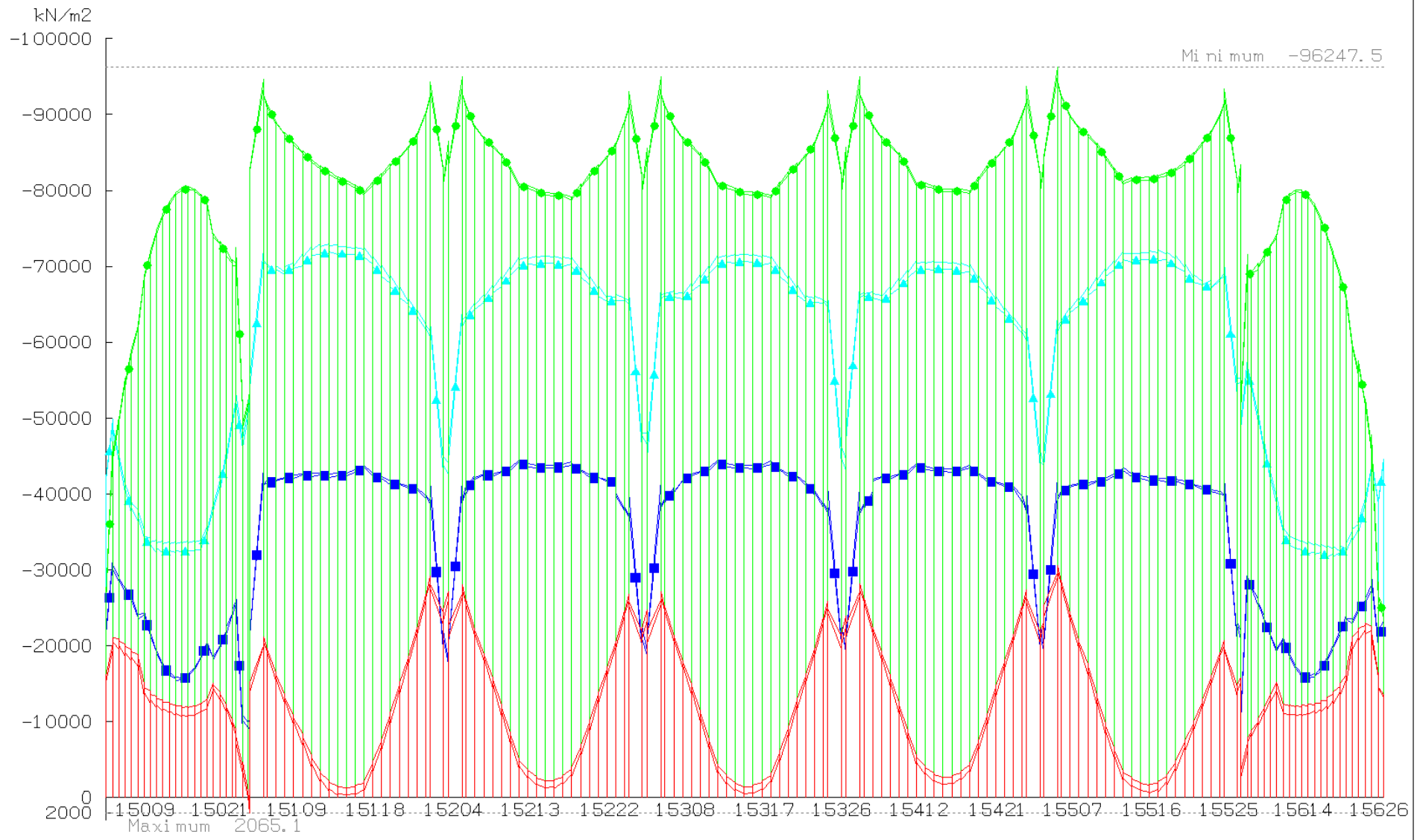
RmSet: 07-G7-Reinf, Stage: A7-reinf-stress

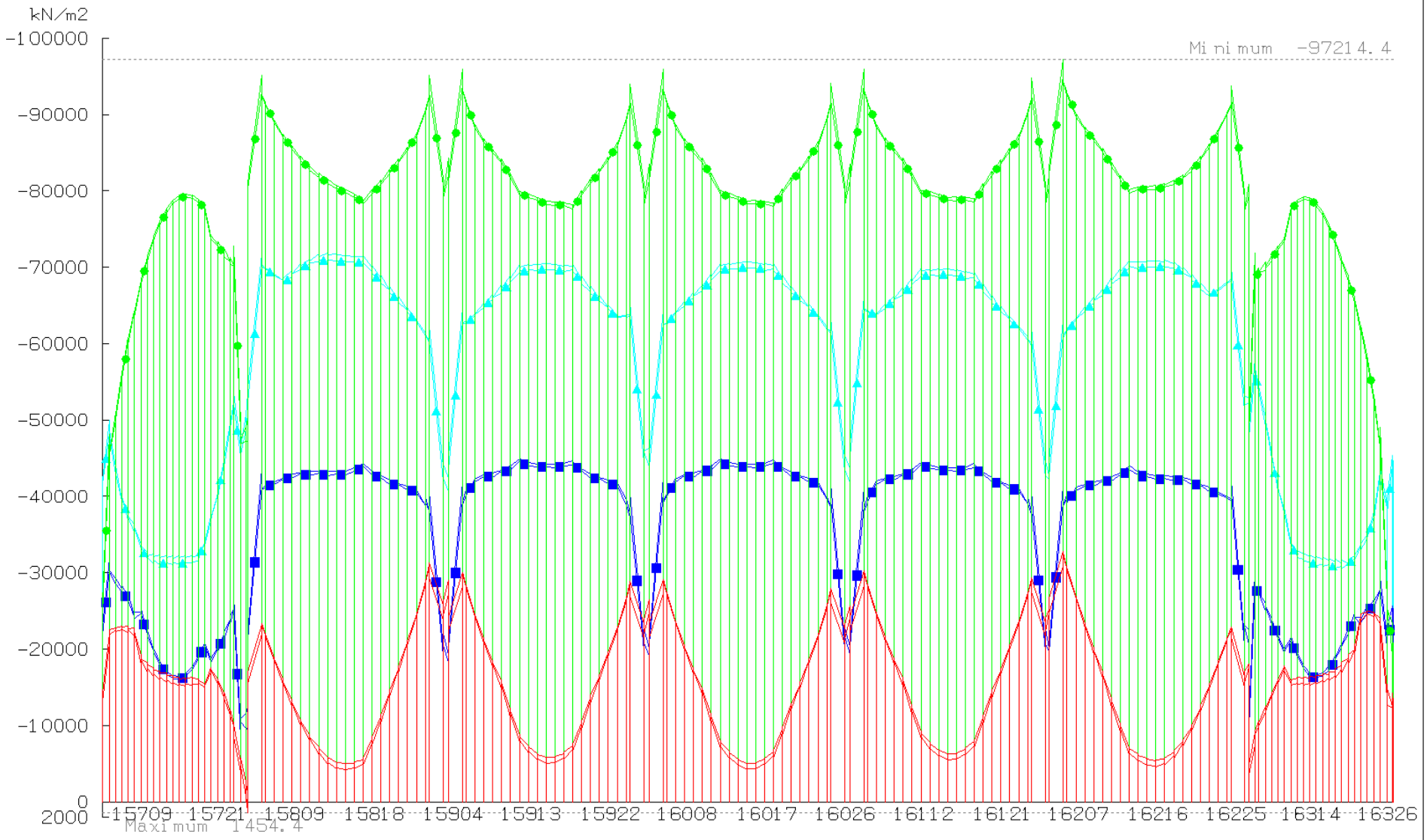
(DefaultSchedule)/A7-reinf-G7

1 cm Plot = 7911.9 kN/m2

0 7911.9 15823.8 23735.7 31647.6 39559.5

19/07/2021
10:50


kN/m2
-100000
-90000
-80000
-70000
-60000
-50000
-40000
-30000
-20000
-10000
0
2000
Minimum -96247.5
Maximum 2065.1
15009 15021 15109 15118 15204 15213 15222 15308 15317 15326 15412 15421 15507 15516 15525 15614 15626
SLS-charac. sup Max LongG-B (-30610 , 2065)
SLS-charac. sup Min LongG-B (-96247 , -23533)
SLS-charac. sup Max LongG-T (-44456 , -8594)
SLS-charac. sup Min LongG-T (-72984 , -31695)



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 9, Part 2, STRESS, SLS-charac.sup

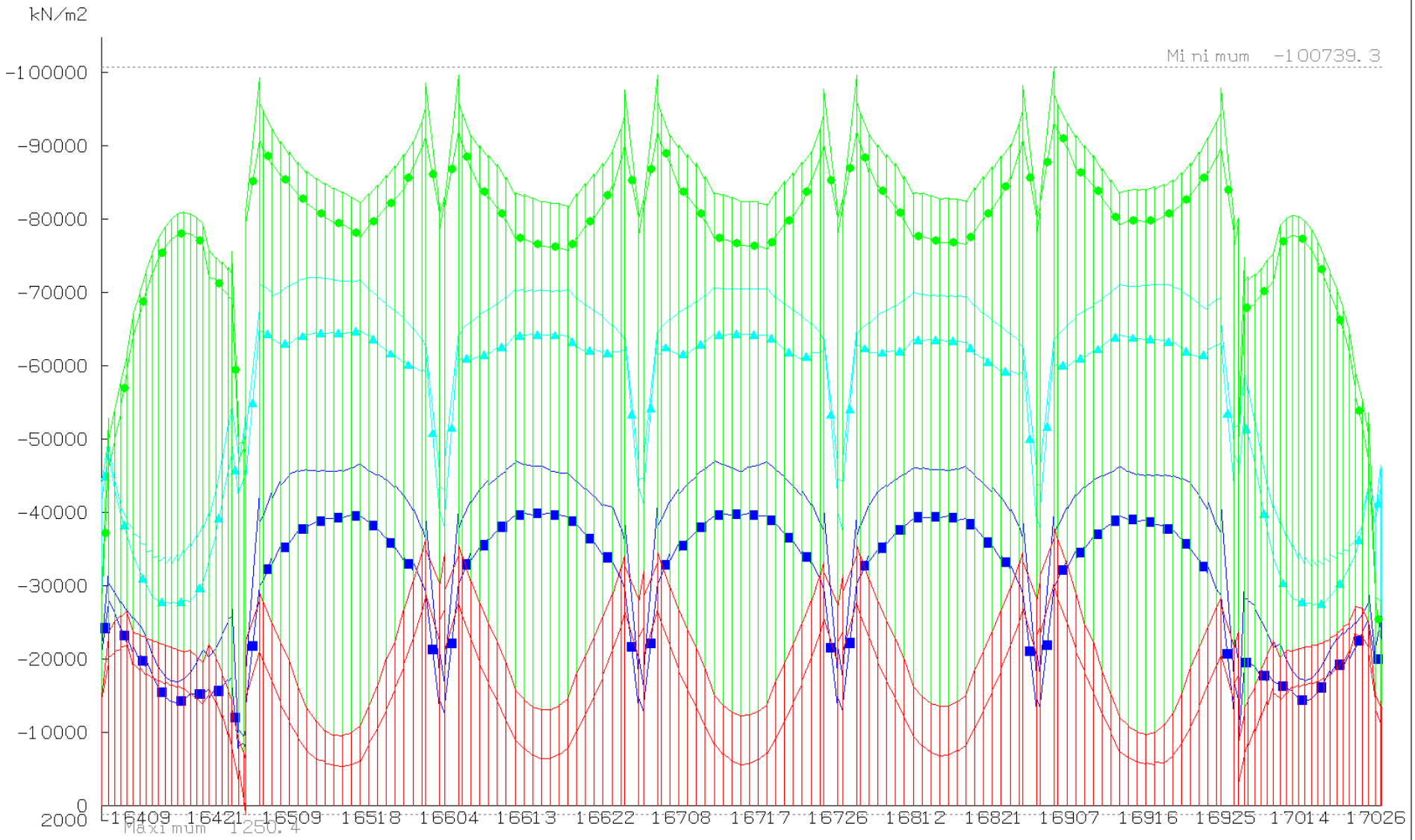
RmSet: 07-G9-Reinf, Stage: A7-reinf-stress

(DefaultSchedule)/A7-reinf-G9

1 cm Plot = 7815.4 kN/m2

0 7815.4 15630.7 23446.1 31261.4 39076.8

19/07/2021
10:50



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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 10, Part 2, STRESS, SLS-charac.sup

RmSet: 07-G10-Reinf, Stage: A7-reinf-stress

(DefaultSchedule)/A7-reinf-G10

1 cm Plot = 8078.4 kN/m2

0 8078.4 16156.8 24235.2 32313.6 40391.9

19/07/2021
10:50

4.4.2.9 Контрола угиба

Deflections

КОНТРОЛА УГИБА У ФАЗИ ГРАЂЕЊА /Deflection check in stage one

Извршена је провера угиба у фази грађења. Проверено је колико је одизање монтажног носача након утезања ужади, очвршћавања бетона носача и обављеног скупљања и течења бетона и релаксације челика./

Deflections are checked in stage one, after installation of precast girders. Prestressing deflections after tendon stressing are shown, following deflections after concrete stregthening and deflections as consequance of time deformation effects(creep and shrinkage and steel relaxation).

Ознаке на дијаграму /Graph legend:

- **угиб на доле** /sagging

+ **угиб на горе (одизање)/**lifting

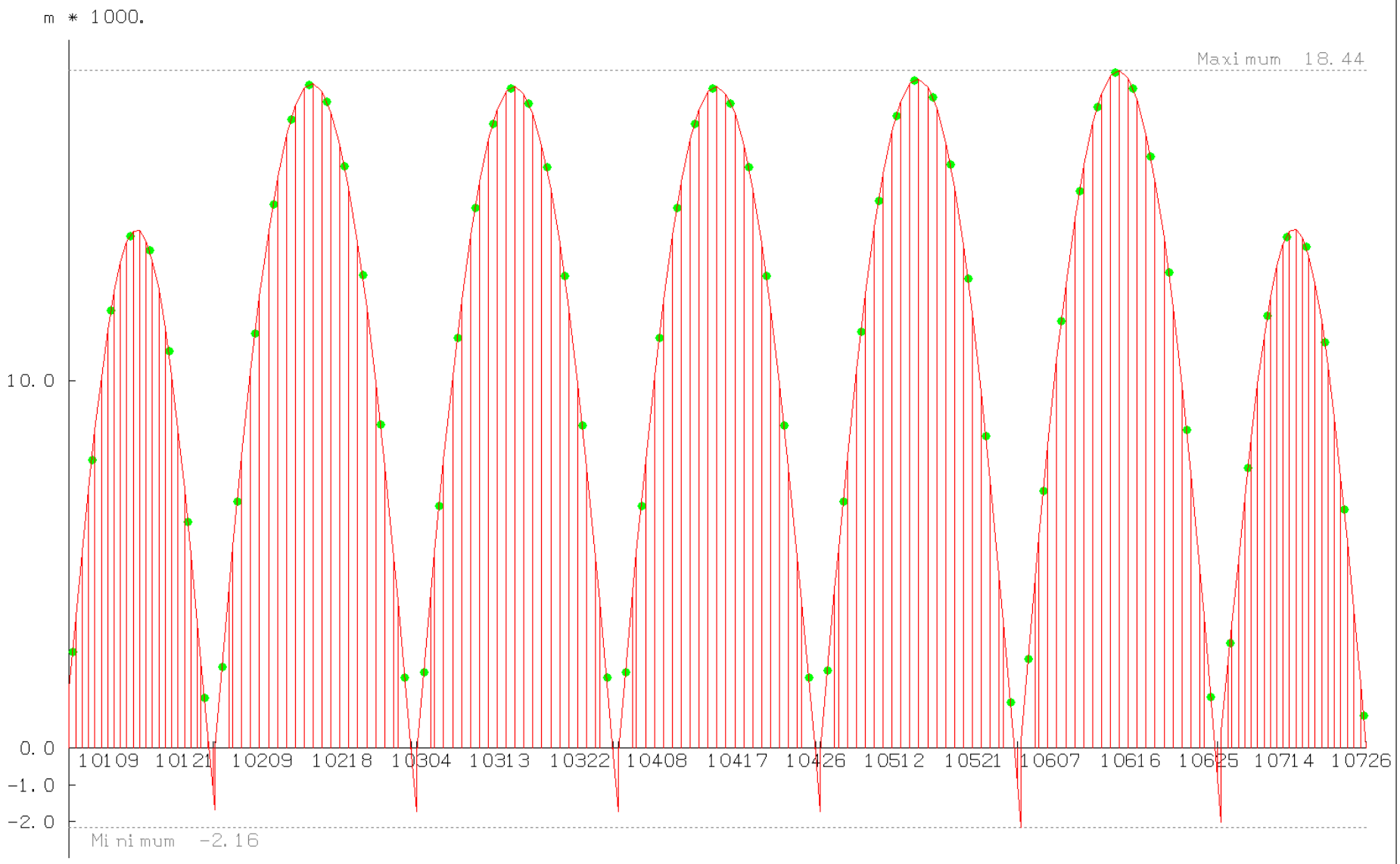
Girder-SW – **угиб од сопствене тежине монтажног носача /**precast girder self weight (Vy=-27.6 mm)

Precast-PT(PT-SL1) – **угиб од утицаја утезања каблова** /presstreing of tendons (Vy=11.6mm)

Precast-CS – **угиб од скупљања и течења бетона монтажног носача, утицај релаксације челика на угиб носача** / creep and shrinkage of precast girder concrete steel relaxation (Vy=-6.9 mm)

Comb01 =1.0* Girder-SW +1.0* Precast-PT +1.0* Precast-CS

(Vy=22.9 mm)



Comb01.sup
MaxVy: Vy
total: global: normal
(-2.2, 18.4)

Comb01.sup
MaxMz: Vy
total: global: normal
(-2.2, 18.4)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering, Beograd

Project: 95+739

Results for Max, All Spans, Girder 1, Part 2, STRESS, SLS-charac.sup

RmSet: 08-Deflection, Stage: A8-deflection

(DefaultSchedule)/A8-DEF-1

1 cm Plot = 0.00163 m

0 0.00163 0.00326 0.00490 0.00653 0.00816

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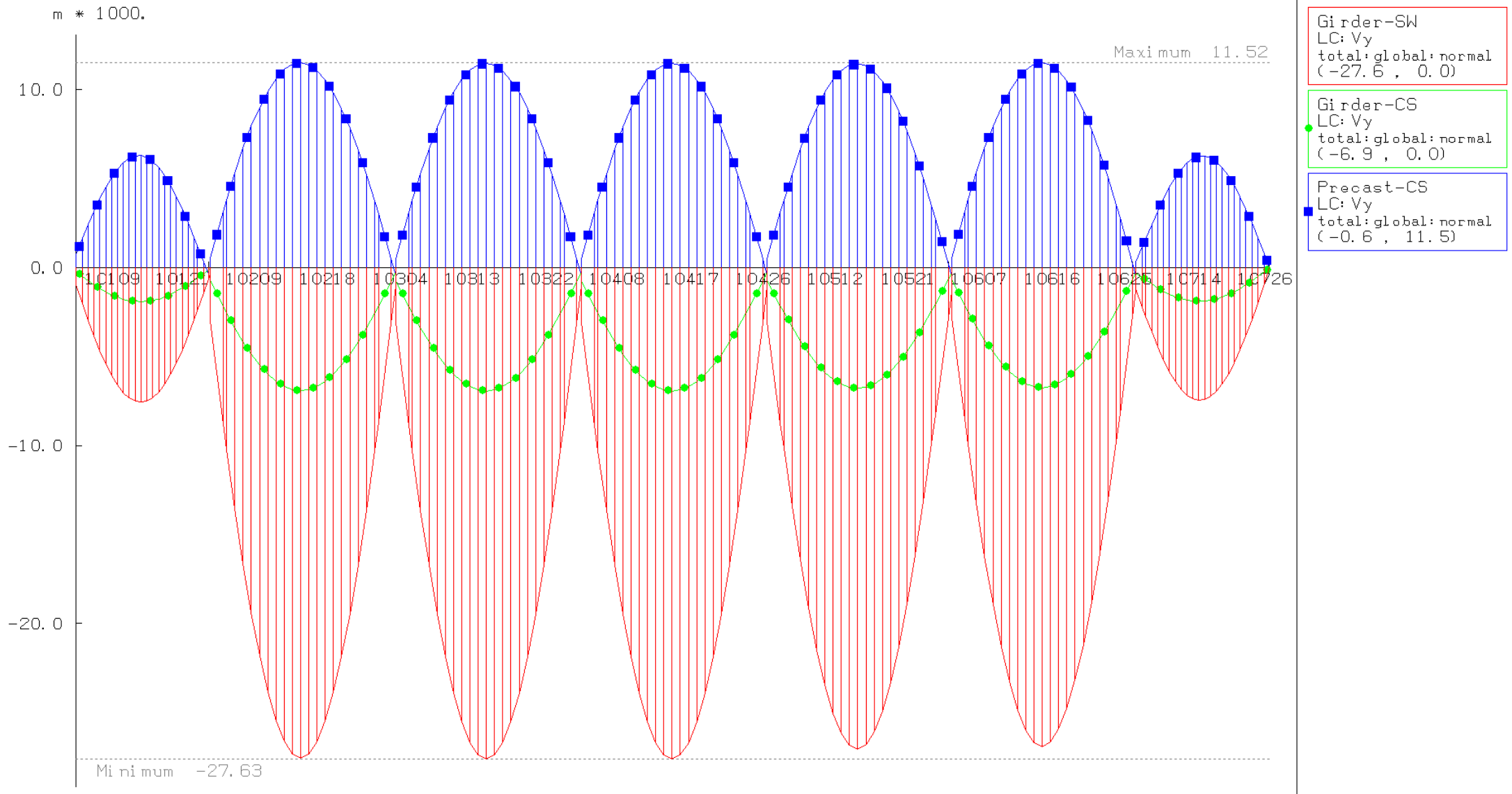
10:50



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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for Max, All Spans, Girder 1, Part 2, STRESS, SLS-charac.sup

RmSet: AL-St-G-defl, Stage: A8-deflection

(DefaultSchedule)/A8-DEF-2

1 cm Plot = 0.00310 m

0 0.00310 0.00620 0.00930 0.01240 0.01550

19/07/2021
10:50

4.4.3 КОНТРОЛА ГРАНИЧНОГ СТАЊА НОСИВОСТИ
ANALYSIS AT THE ULTIMATE LIMIT STATE

4.4.3.1 Прорачун арматуре у монтажном носачу

Precast girder reinforcing steel

ЛЕГЕНДА ДИЈАГРАМА АРМАТУРЕ /LEGEND

LongG-B - **Подужна арматура у носачу у доњој зони** /bottom zone precast girder reinforcement

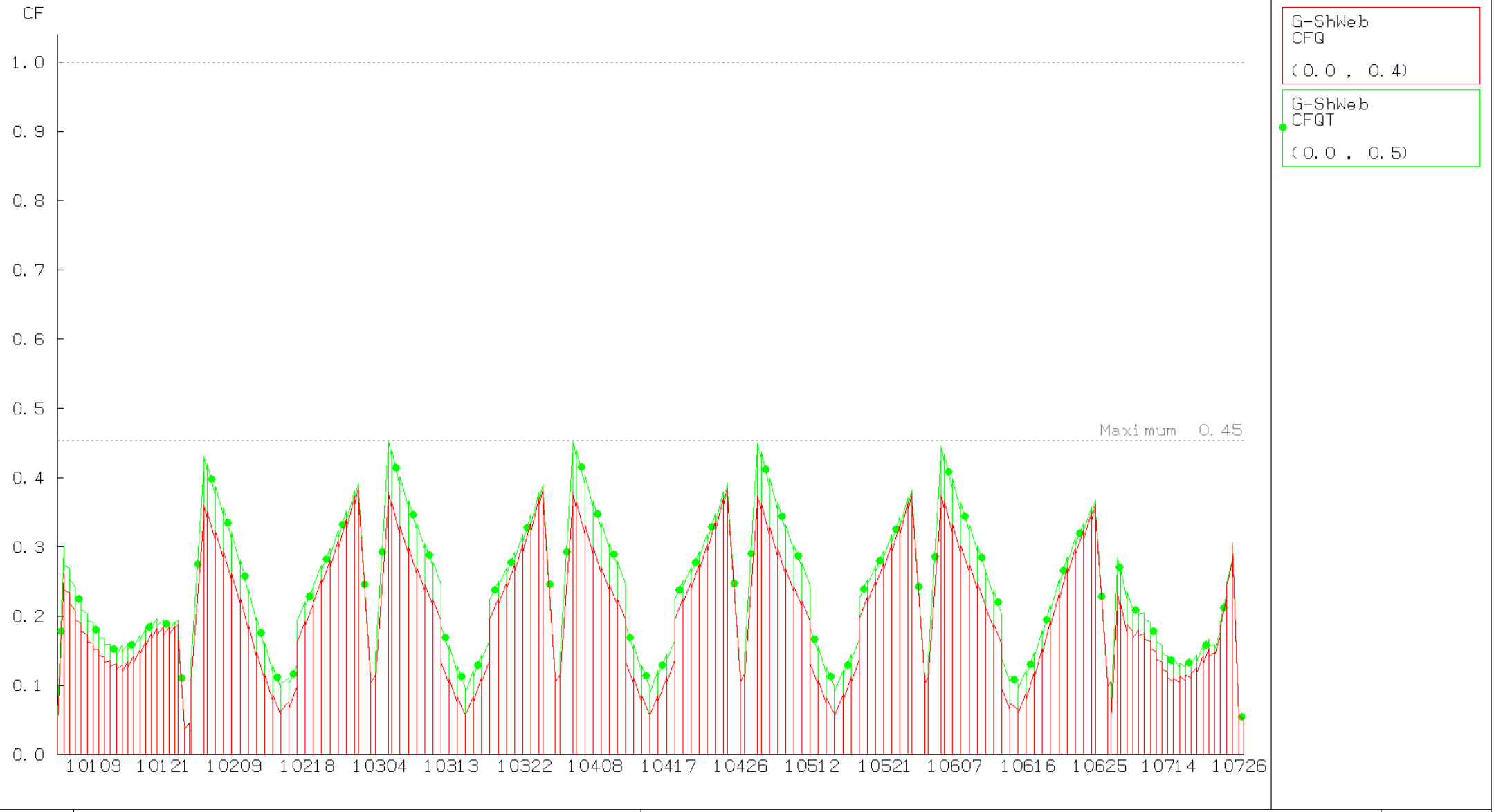
LongG-T - **Подужна арматура у носачу у горњој зони** /top zone precast girder reinforcement

G-ShWeb (AVQ/AVQT) – **Смичућа арматура(без/са интеракцијом смицања и торзије)/** Shear web reinforcement(no/with Interaction shear+torsion)

G-ShWeb (CFQ/CFQT) - **Капацитет носивости пресека на смицање(без/са интеракцијом смицања и торзије)** Resistance capacity factor (Shear/ Shear+Torsion)

G-ShLong(AL+M)- **Подужна арматура услед смицања(доња зона)/** Shear-longitudinal reinf. (bottom)

G-ShLong(AL-M)- **Подужна арматура услед смицања(горња зона)/** Shear-longitudinal reinf. (top)



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 1, Part 1, REIN, Deck-BendS-T

RmSet: 09-G1-CF, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G1-CF

1 cm Plot = 0.0792 CF

0 0.0792 0.1584 0.2376 0.3168 0.3960

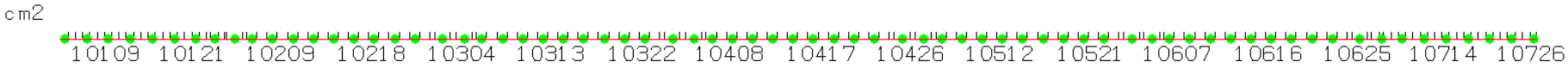
19/07/2021
10:50

LongG-B
AL

(0.0 , 0.0)

LongG-T
AL

(0.0 , 0.0)



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 1, Part 1, REIN, Deck-BendS-T

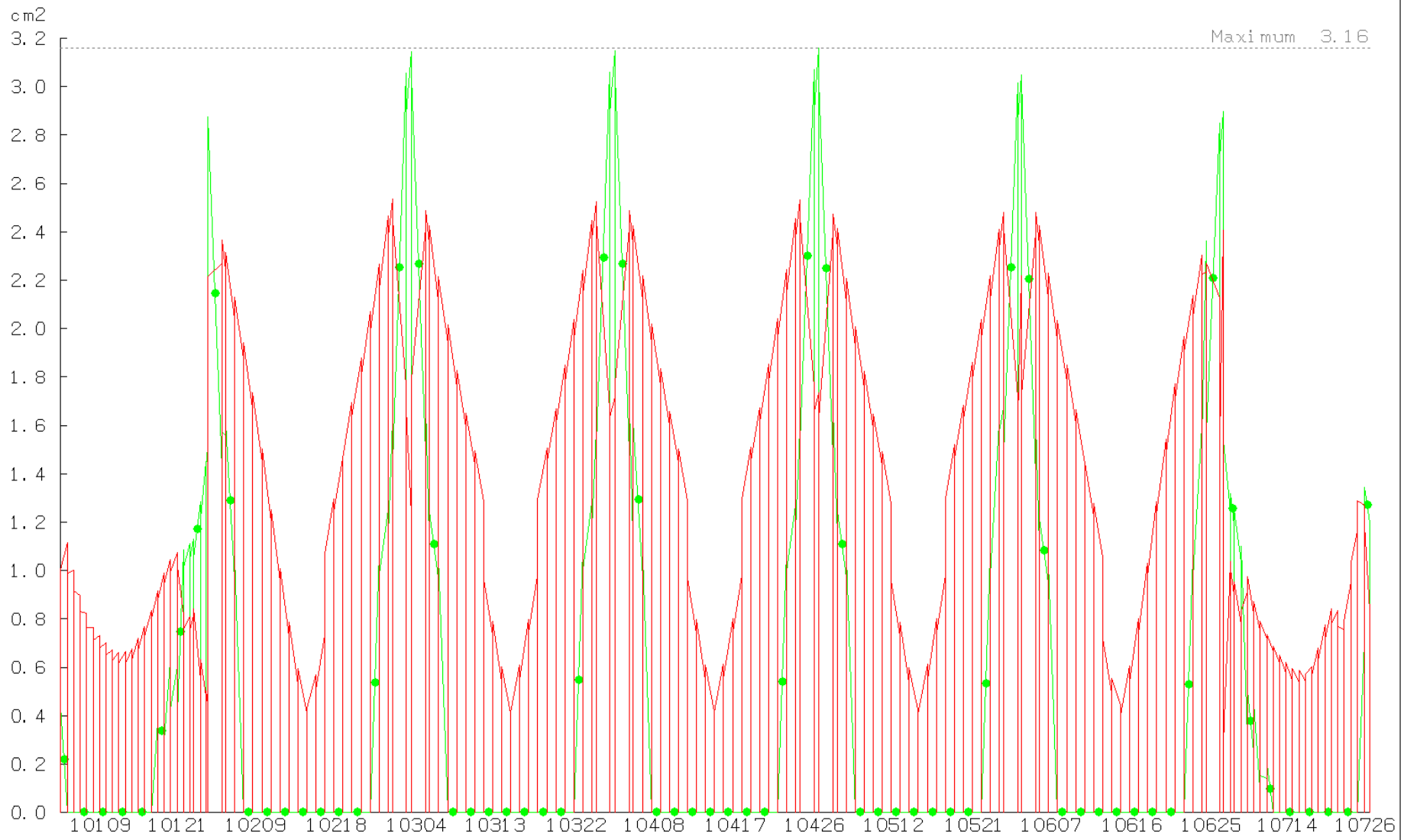
RmSet: 09-G1-ReinfLong, Stage: B9-Girder-reinf

1 cm Plot = 0.00377 cm2

(DefaultSchedule)/B9-G1-Long

0 0.00377 0.00753 0.01130 0.01507 0.01884

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 1, Part 1, REIN, Deck-BendS-T

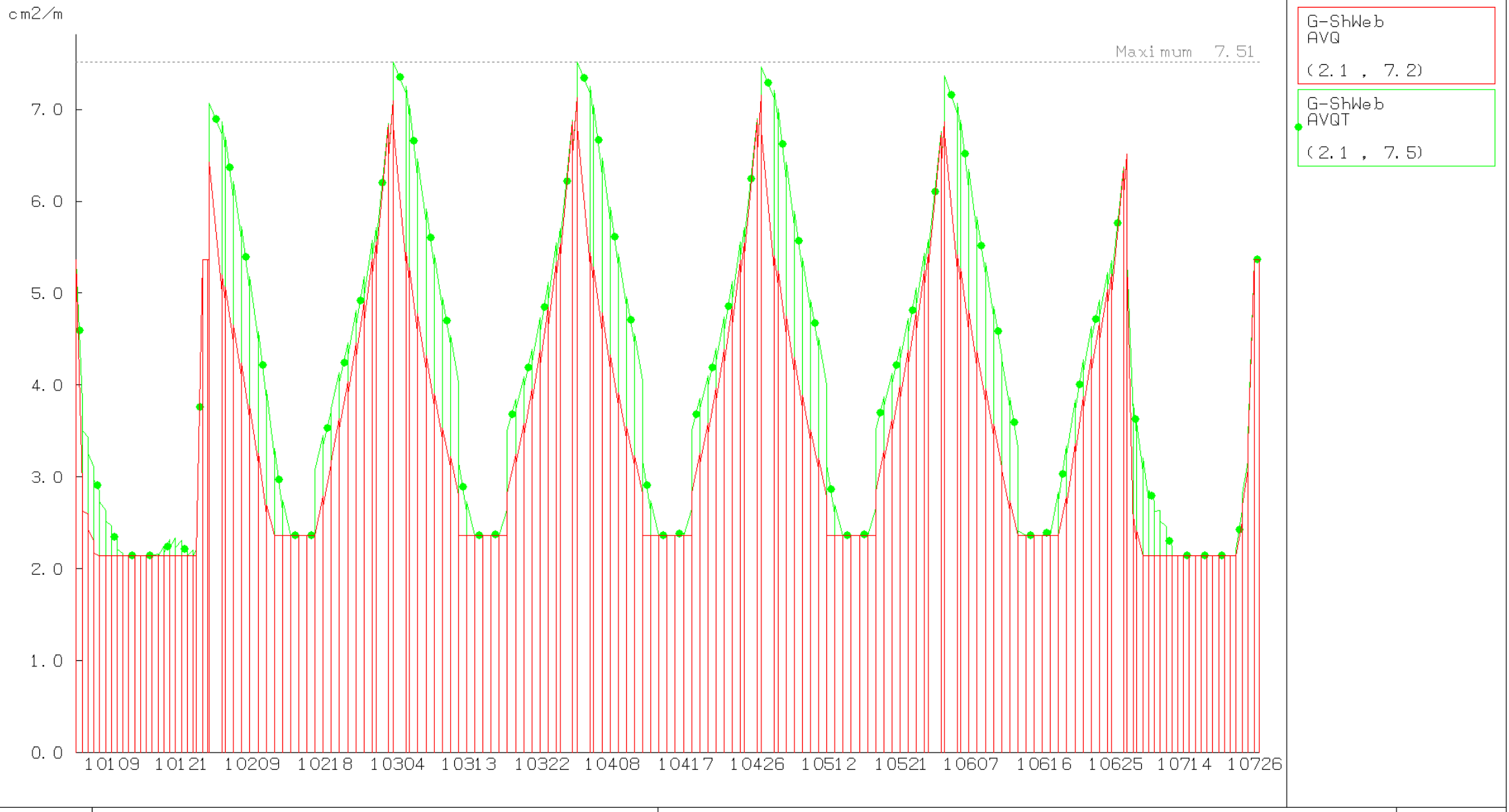
RmSet: 09-G1-ShearLong, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G1-ShLong

1 cm Plot = 0.250 cm2

0 0.250 0.500 0.751 1.001 1.251

19/07/2021
10:50



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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 1, Part 1, REIN, Deck-BendS-T

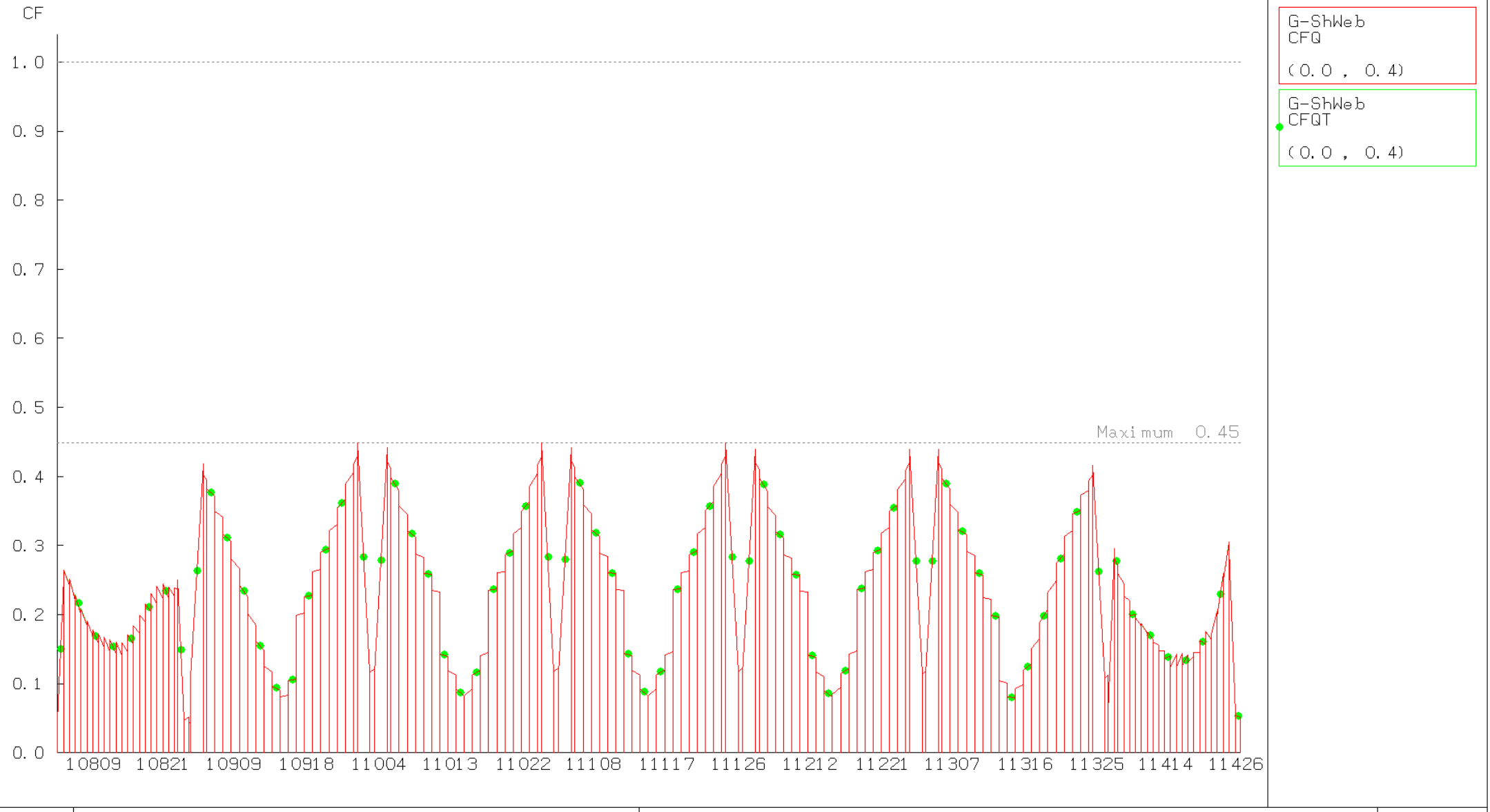
RmSet: 09-G1-ShearWeb, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G1-ShWeb

1 cm Plot = 0.595 cm2/m

0 0.595 1.190 1.786 2.381 2.976

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 2, Part 1, REIN, Deck-BendS-T

RmSet: 09-G2-CF, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G2-CF

1 cm Plot = 0.0792 CF

0 0.0792 0.1584 0.2376 0.3168 0.3960

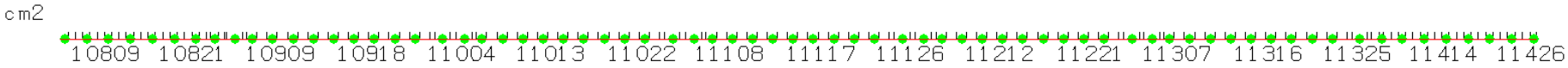
19/07/2021
10:50

LongG-B
AL

(0.0 , 0.0)

LongG-T
AL

(0.0 , 0.0)



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 2, Part 1, REIN, Deck-BendS-T

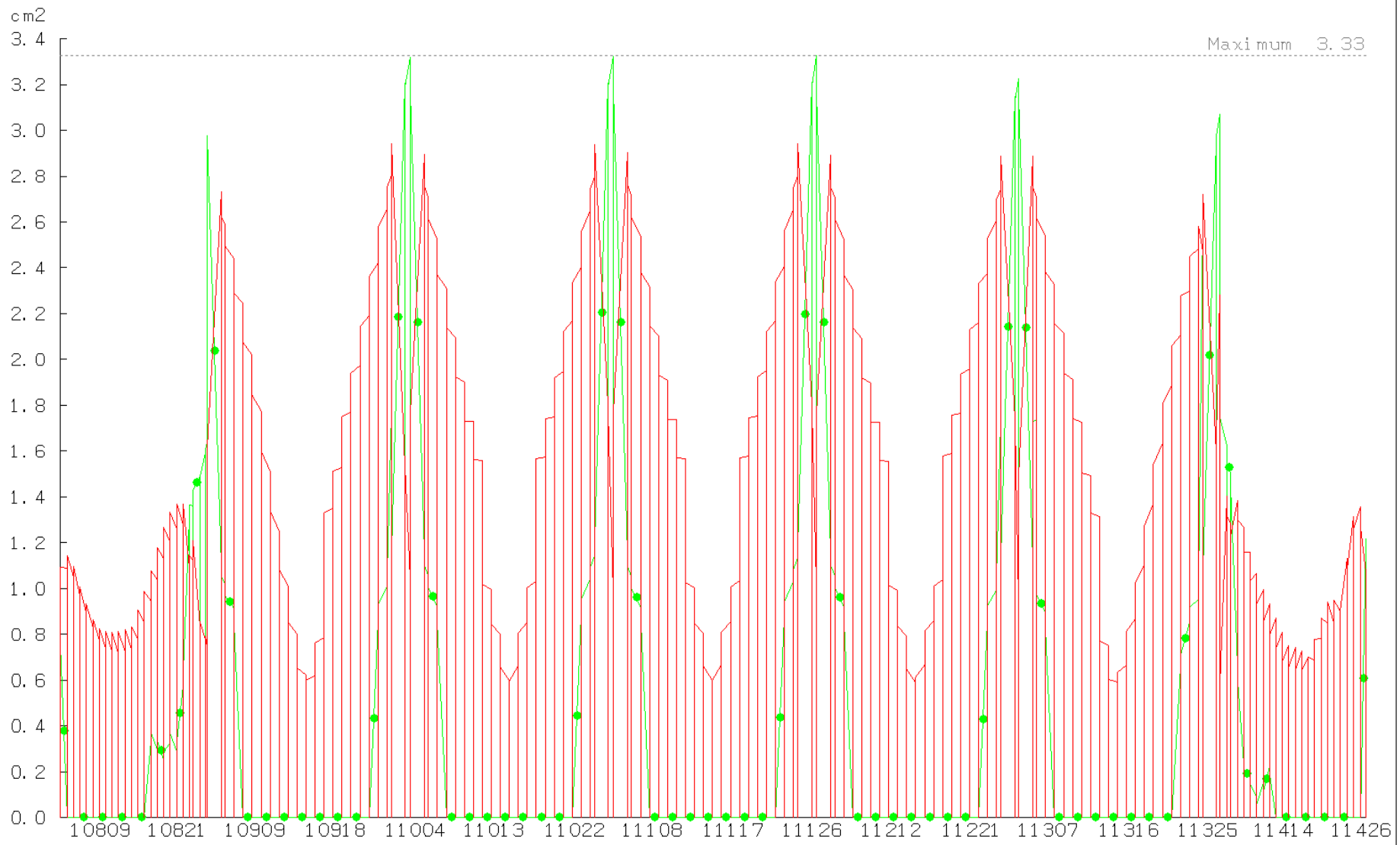
RmSet: 09-G2-ReinfLong, Stage: B9-Girder-reinf

1 cm Plot = 0.00377 cm2

(DefaultSchedule)/B9-G2-Long

0 0.00377 0.00753 0.01130 0.01507 0.01884

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 2, Part 1, REIN, Deck-BendS-T

RmSet: 09-G2-ShearLong, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G2-ShLong

1 cm Plot = 0.263 cm2

0 0.263 0.527 0.790 1.054 1.317

19/07/2021
10:50

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 2, Part 1, REIN, Deck-BendS-T

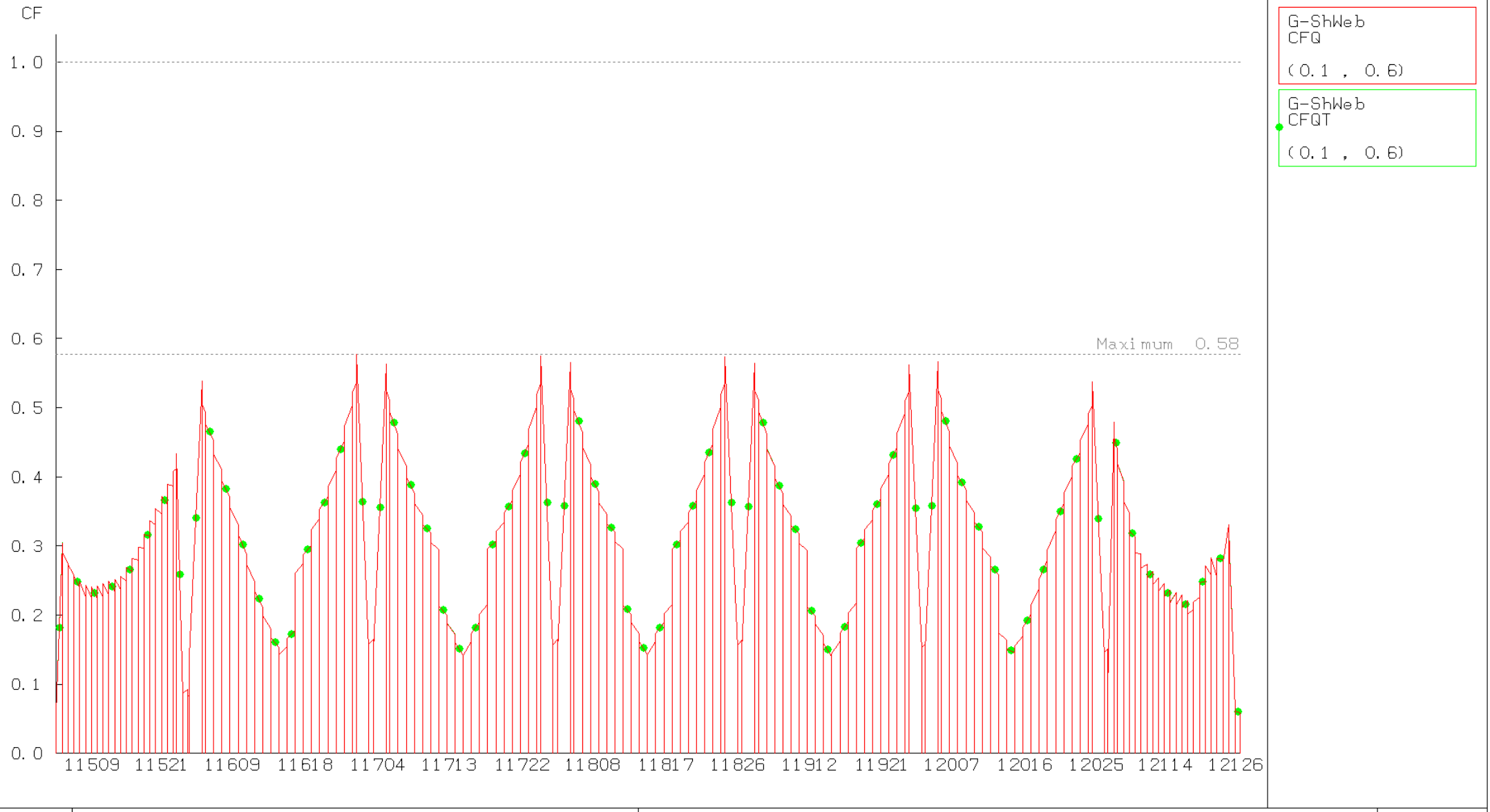
RmSet: 09-G2-ShearWeb, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G2-ShWeb

1 cm Plot = 0.601 cm2/m

0 0.601 1.203 1.804 2.405 3.006

19/07/2021
10:50


CF
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Maximum 0.58
11509
11521
11609
11618
11704
11713
11722
11808
11817
11826
11912
11921
12007
12016
12025
12114
12126
G-ShWeb
CFQ
(0.1 , 0.6)
G-ShWeb
CFQT
(0.1 , 0.6)

LongG-B
AL

(0.0 , 0.0)

LongG-T
AL

(0.0 , 0.0)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 3, Part 1, REIN, Deck-BendS-T

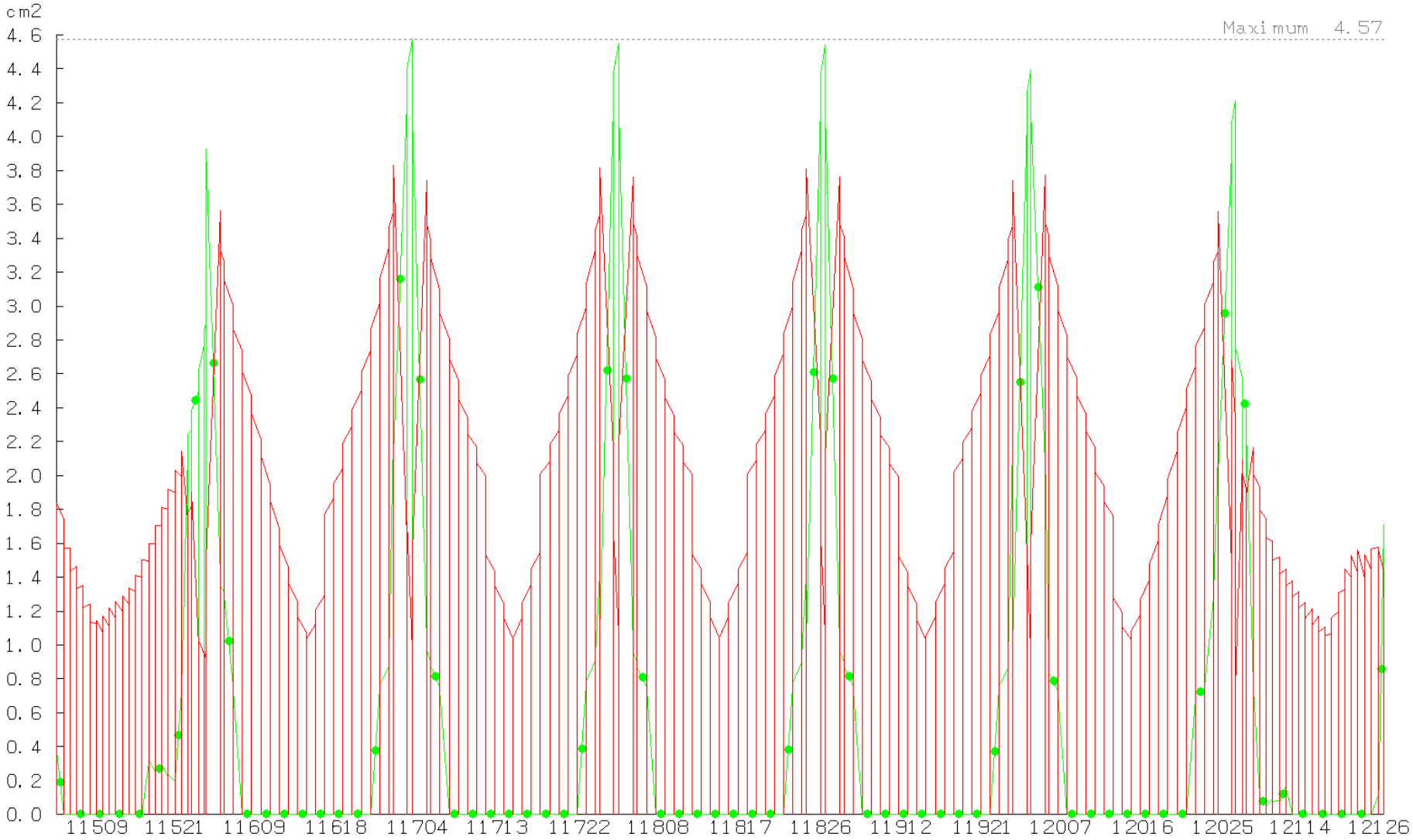
RmSet: 09-G3-ReinfLong, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G3-Long

1 cm Plot = 0.00377 cm2

0 0.00377 0.00753 0.01130 0.01507 0.01884

19/07/2021
10:50



G-ShLong
AL+M
(0.7 , 3.8)

G-ShLong
AL-M
(0.0 , 4.6)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 3, Part 1, REIN, Deck-BendS-T

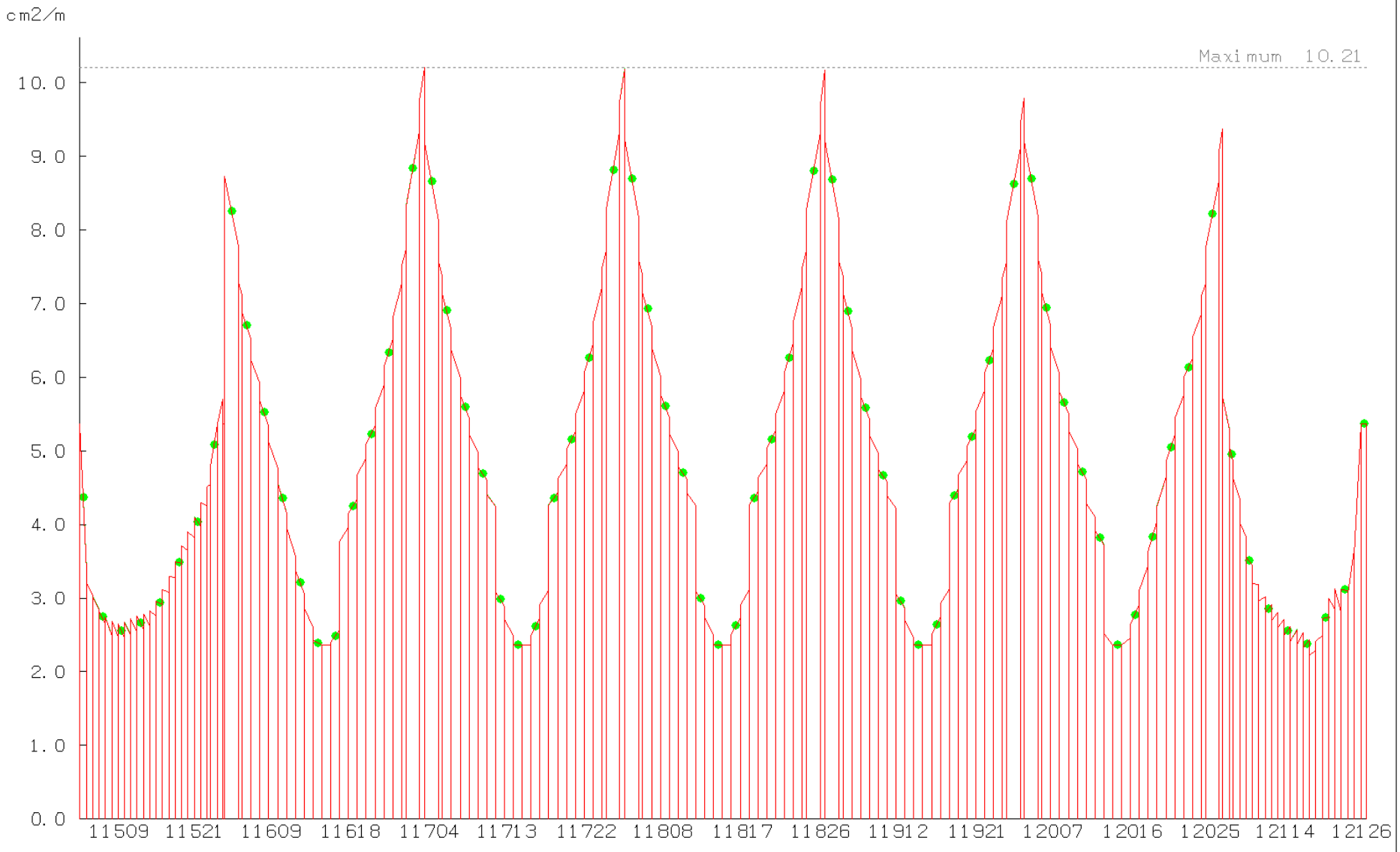
RmSet: 09-G3-ShearLong, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G3-ShLong

1 cm Plot = 0.362 cm2

0 0.362 0.725 1.087 1.449 1.811

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 3, Part 1, REIN, Deck-BendS-T

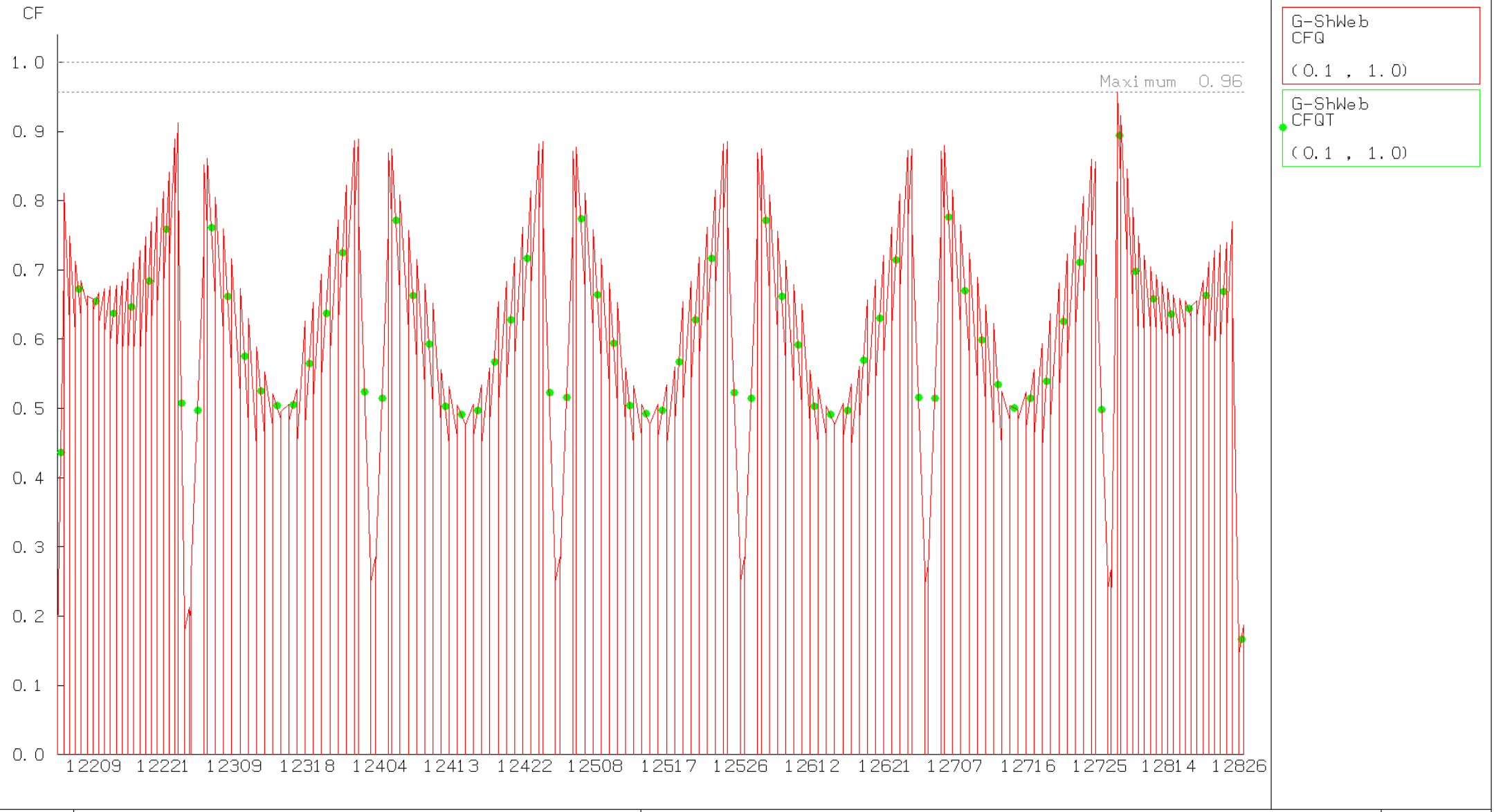
RmSet: 09-G3-ShearWeb, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G3-ShWeb

1 cm Plot = 0.809 cm2/m

0 0.809 1.617 2.426 3.234 4.043

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 4, Part 1, REIN, Deck-BendS-T

RmSet: 09-G4-CF, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G4-CF

1 cm Plot = 0.0792 CF

0 0.0792 0.1584 0.2376 0.3168 0.3960

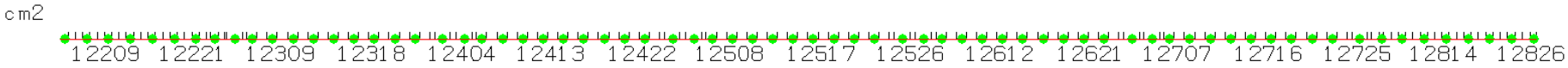
19/07/2021
10:50

LongG-B
AL

(0.0 , 0.0)

LongG-T
AL

(0.0 , 0.0)



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 4, Part 1, REIN, Deck-BendS-T

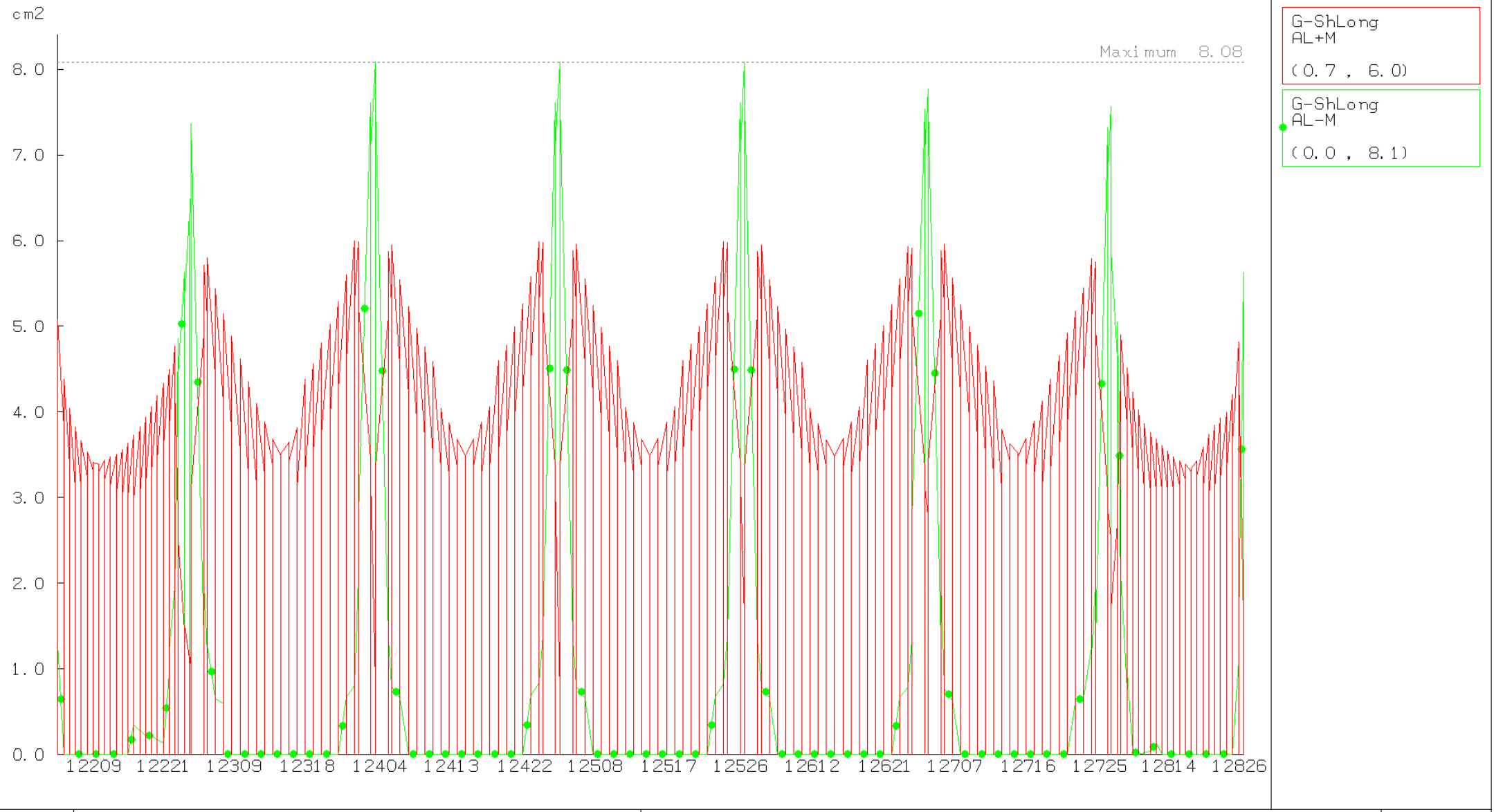
RmSet: 09-G4-ReinfLong, Stage: B9-Girder-reinf

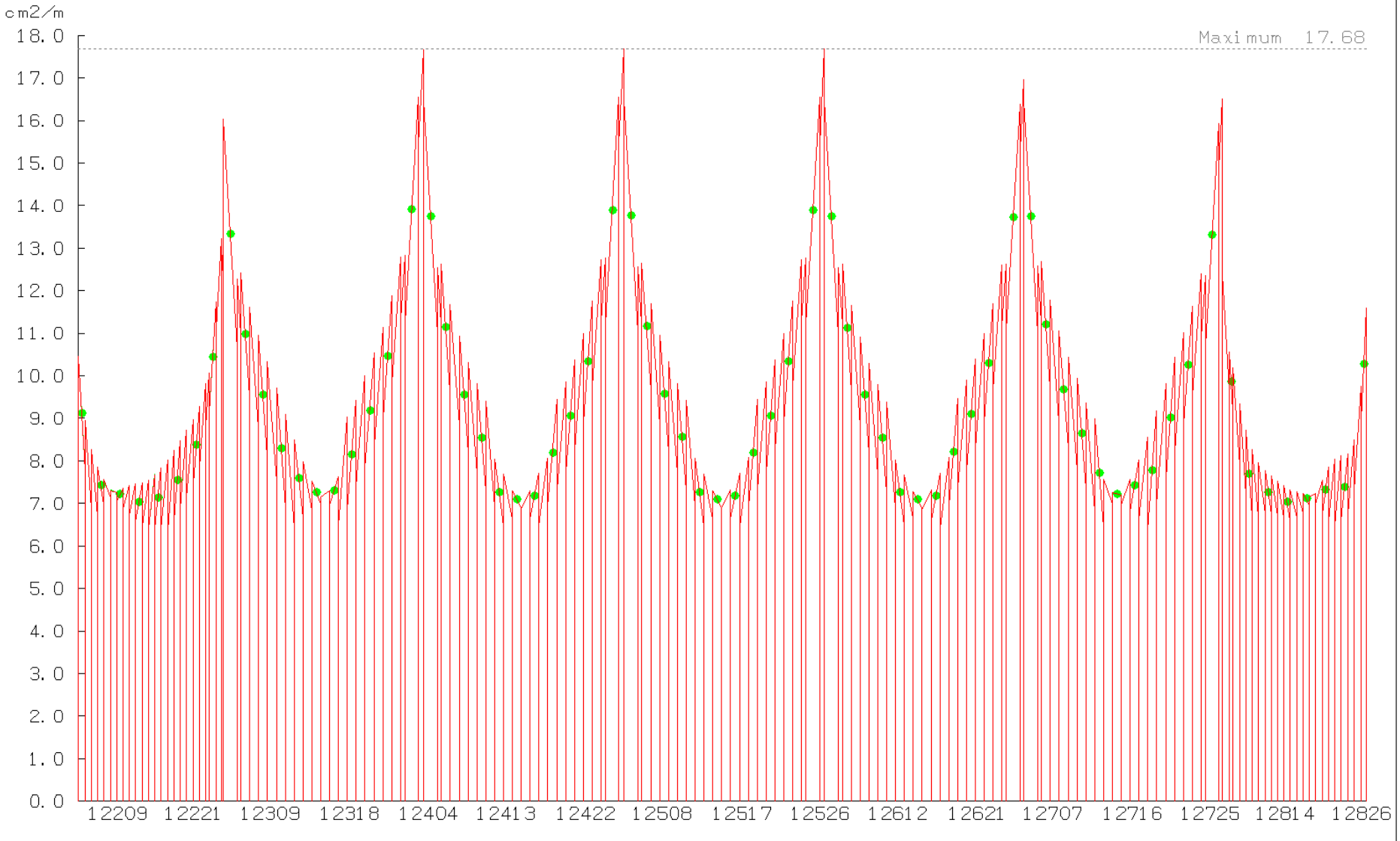
1 cm Plot = 0.00377 cm2

(DefaultSchedule)/B9-G4-Long

0 0.00377 0.00753 0.01130 0.01507 0.01884

19/07/2021
10:50


cm2
Maximum 8.08
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
12209 12221 12309 12318 12404 12413 12422 12508 12517 12526 12612 12621 12707 12716 12725 12814 12826
G-ShLong
AL+M
(0.7 , 6.0)
G-ShLong
AL-M
(0.0 , 8.1)



G-ShWeb
AVQ
(6.4 , 17.7)

G-ShWeb
AVQT
(6.4 , 17.7)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 4, Part 1, REIN, Deck-BendS-T

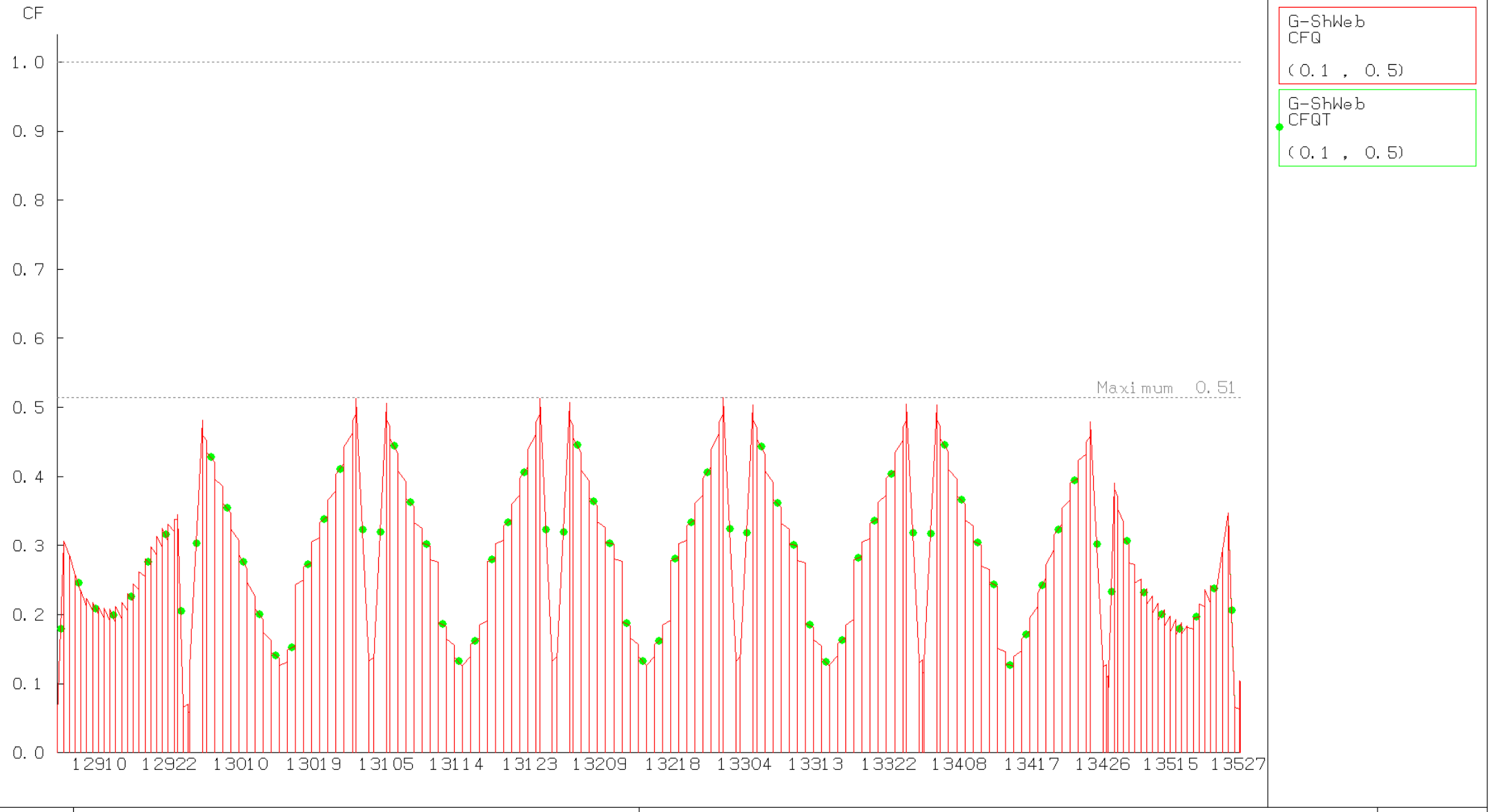
RmSet: 09-G4-ShearWeb, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G4-ShWeb

1 cm Plot = 1.401 cm2/m

0 1.401 2.802 4.202 5.603 7.004

19/07/2021
10:50



Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 5, Part 1, REIN, Deck-BendS-T

RmSet: 09-G5-CF, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G5-CF

1 cm Plot = 0.0792 CF

0 0.0792 0.1584 0.2376 0.3168 0.3960

19/07/2021
10:50

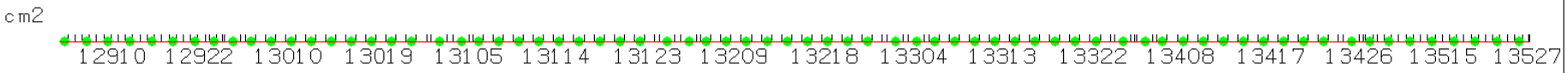
RM Bridge Advanced CONNECT Edition
10.01.00.02

LongG-B
AL

(0.0 , 0.0)

LongG-T
AL

(0.0 , 0.0)



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 5, Part 1, REIN, Deck-BendS-T

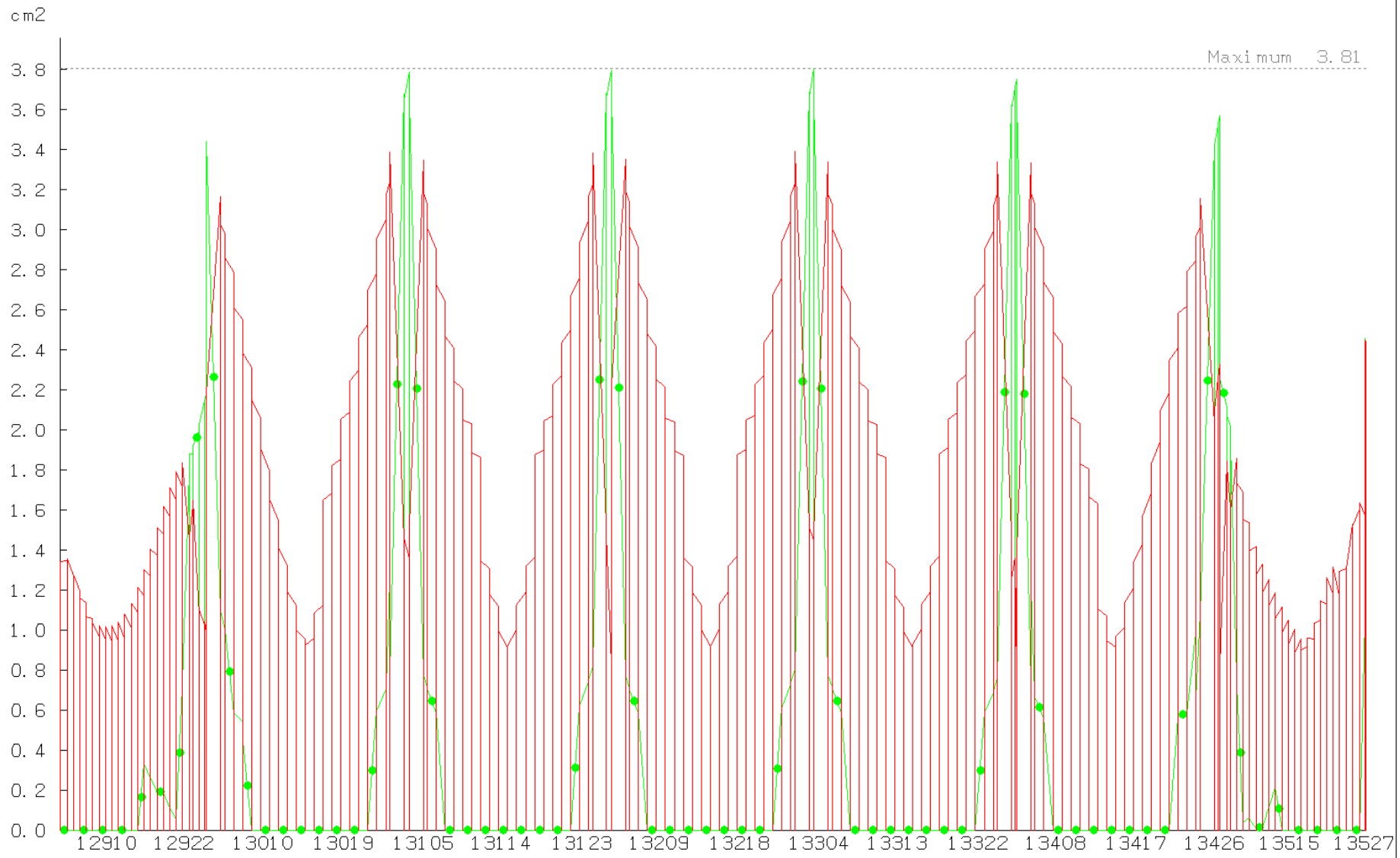
RmSet: 09-G5-ReinfLong, Stage: B9-Girder-reinf

1 cm Plot = 0.00377 cm2

(DefaultSchedule)/B9-G5-Long

0 0.00377 0.00753 0.01130 0.01507 0.01884

19/07/2021
10:50



G-ShLong
AL+M
(0.8 , 3.4)

G-ShLong
AL-M
(0.0 , 3.8)

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10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 5, Part 1, REIN, Deck-BendS-T

RmSet: 09-G5-ShearLong, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G5-ShLong

1 cm Plot = 0.301 cm2

0 0.301 0.603 0.904 1.206 1.507

19/07/2021
10:50

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 5, Part 1, REIN, Deck-BendS-T

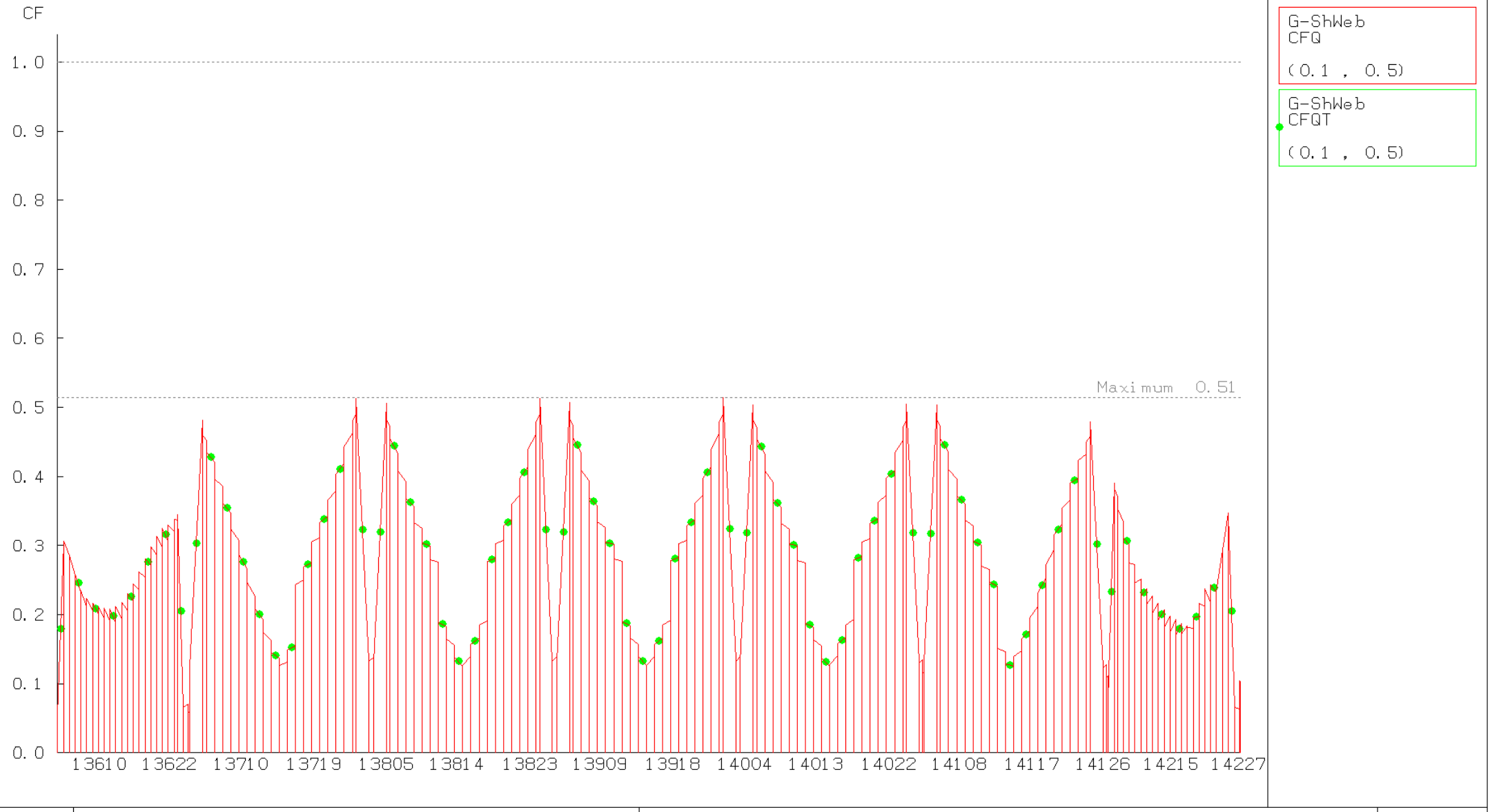
RmSet: 09-G5-ShearWeb, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G5-ShWeb

1 cm Plot = 0.682 cm2/m

0 0.682 1.364 2.045 2.727 3.409

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 6, Part 1, REIN, Deck-BendS-T

RmSet: 09-G6-CF, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G6-CF

1 cm Plot = 0.0792 CF

0 0.0792 0.1584 0.2376 0.3168 0.3960

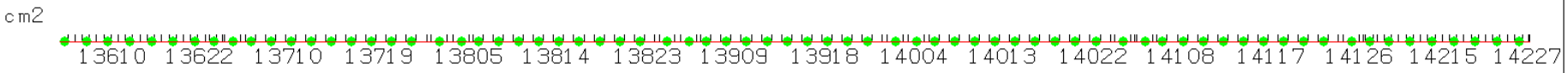
19/07/2021
10:50

LongG-B
AL

(0.0 , 0.0)

LongG-T
AL

(0.0 , 0.0)



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 6, Part 1, REIN, Deck-BendS-T

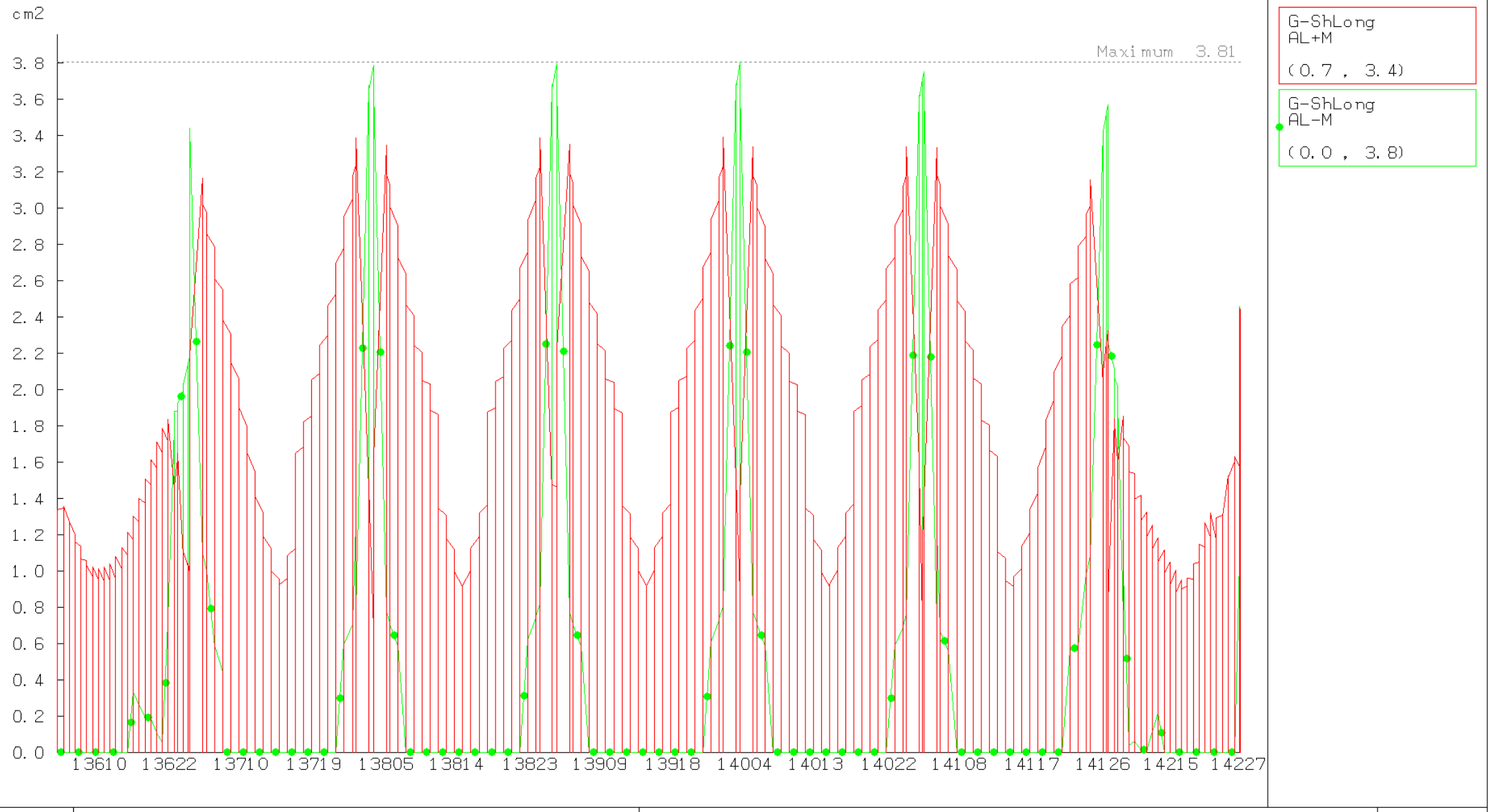
RmSet: 09-G6-ReinfLong, Stage: B9-Girder-reinf

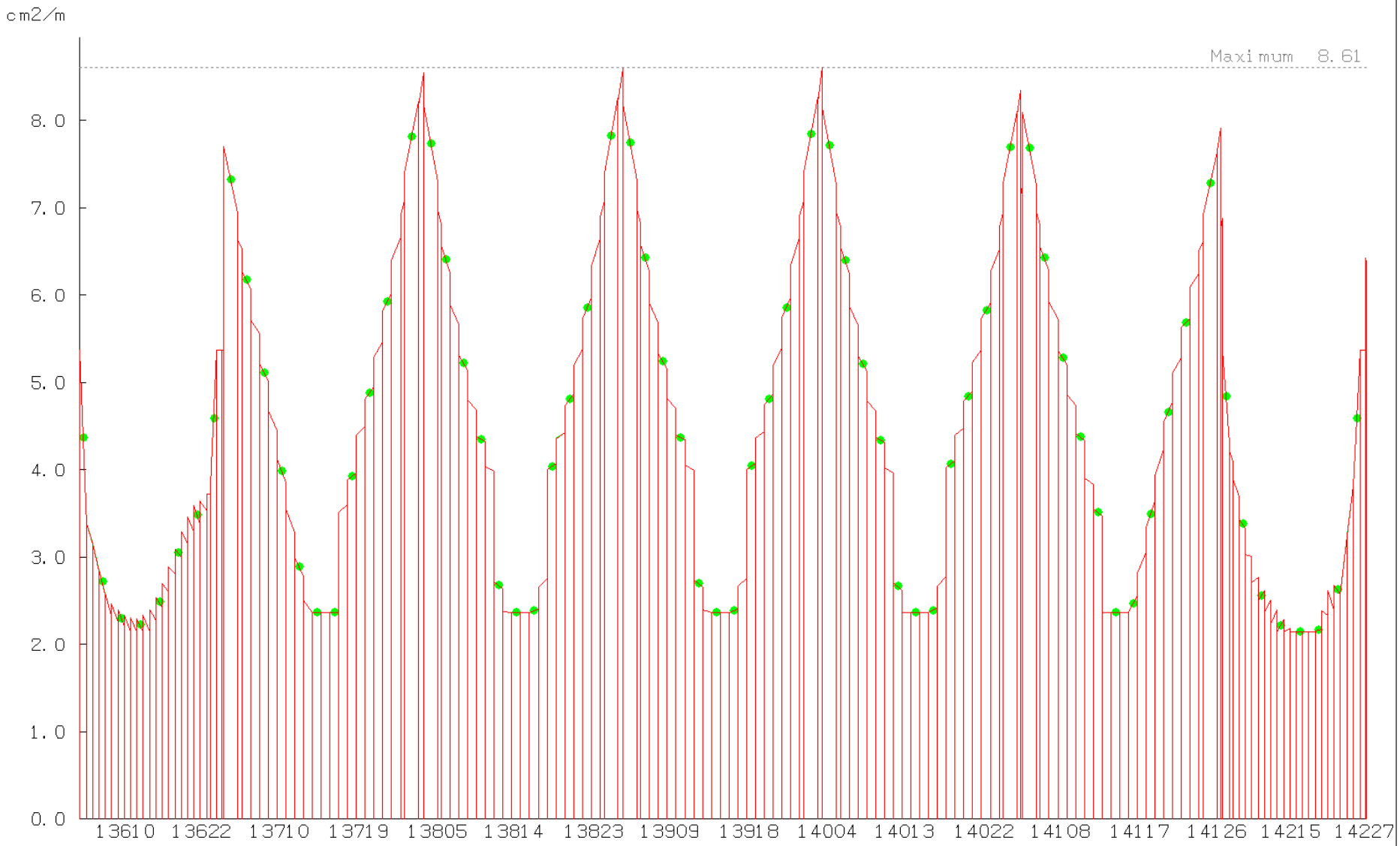
1 cm Plot = 0.00377 cm2

(DefaultSchedule)/B9-G6-Long

0 0.00377 0.00753 0.01130 0.01507 0.01884

19/07/2021
10:50


cm2
Maximum 3.81
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
13610
13622
13710
13719
13805
13814
13823
13909
13918
14004
14013
14022
14108
14117
14126
14215
14227
G-ShLong
AL+M
(0.7 , 3.4)
G-ShLong
AL-M
(0.0 , 3.8)



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 6, Part 1, REIN, Deck-BendS-T

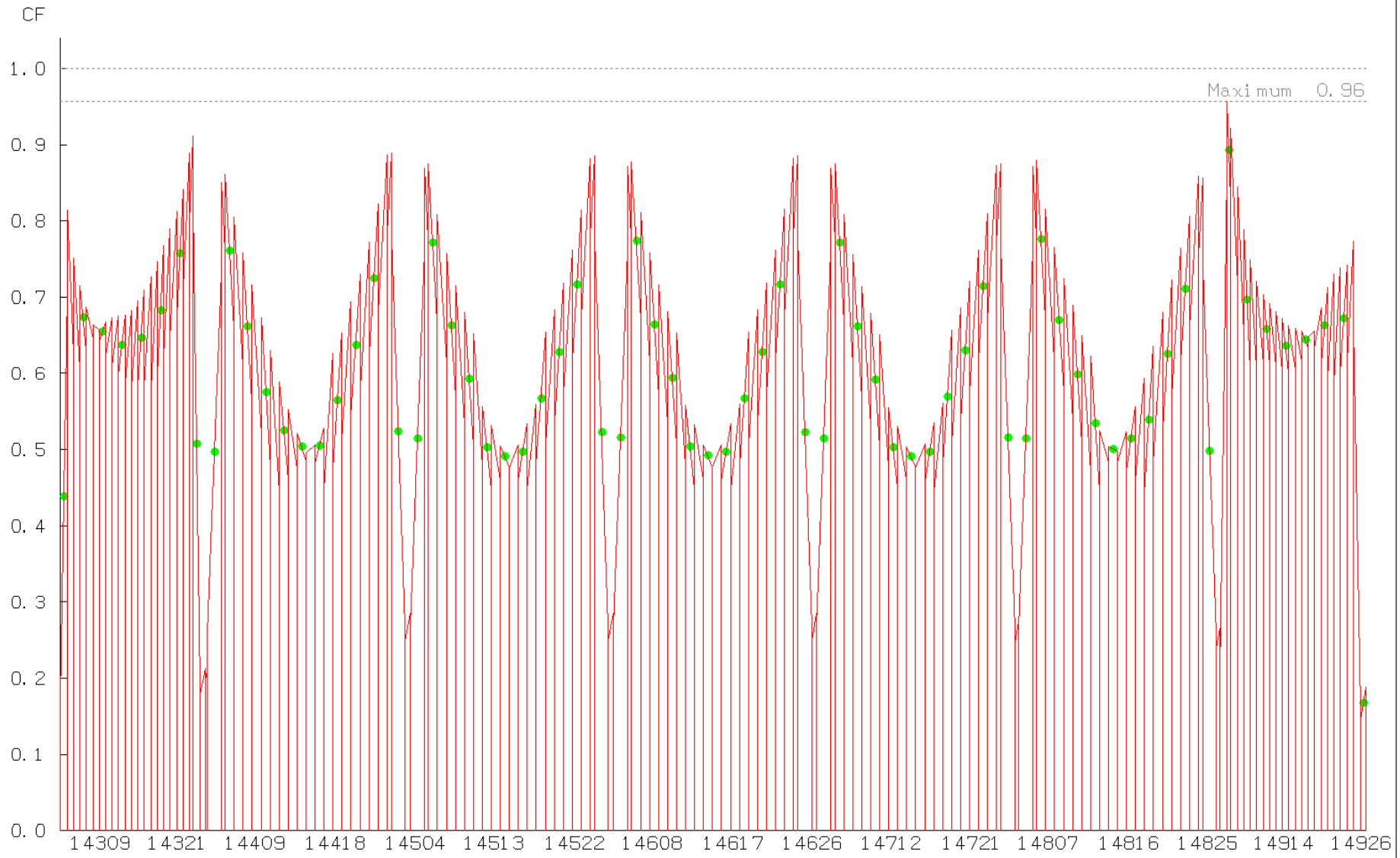
RmSet: 09-G6-ShearWeb, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G6-ShWeb

1 cm Plot = 0.682 cm2/m

0 0.682 1.364 2.045 2.727 3.409

19/07/2021
10:50



G-ShWeb
CFQ
(0.1 , 1.0)

G-ShWeb
CFQT
(0.1 , 1.0)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 7, Part 1, REIN, Deck-BendS-T

RmSet: 09-G7-CF, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G7-CF

1 cm Plot = 0.0792 CF

0 0.0792 0.1584 0.2376 0.3168 0.3960

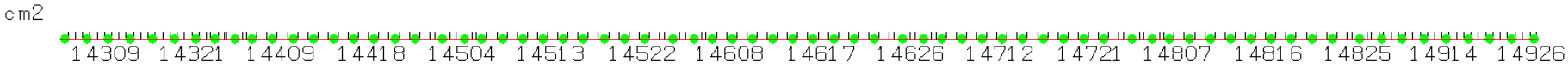
19/07/2021
10:50

LongG-B
AL

(0.0 , 0.0)

LongG-T
AL

(0.0 , 0.0)



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 7, Part 1, REIN, Deck-BendS-T

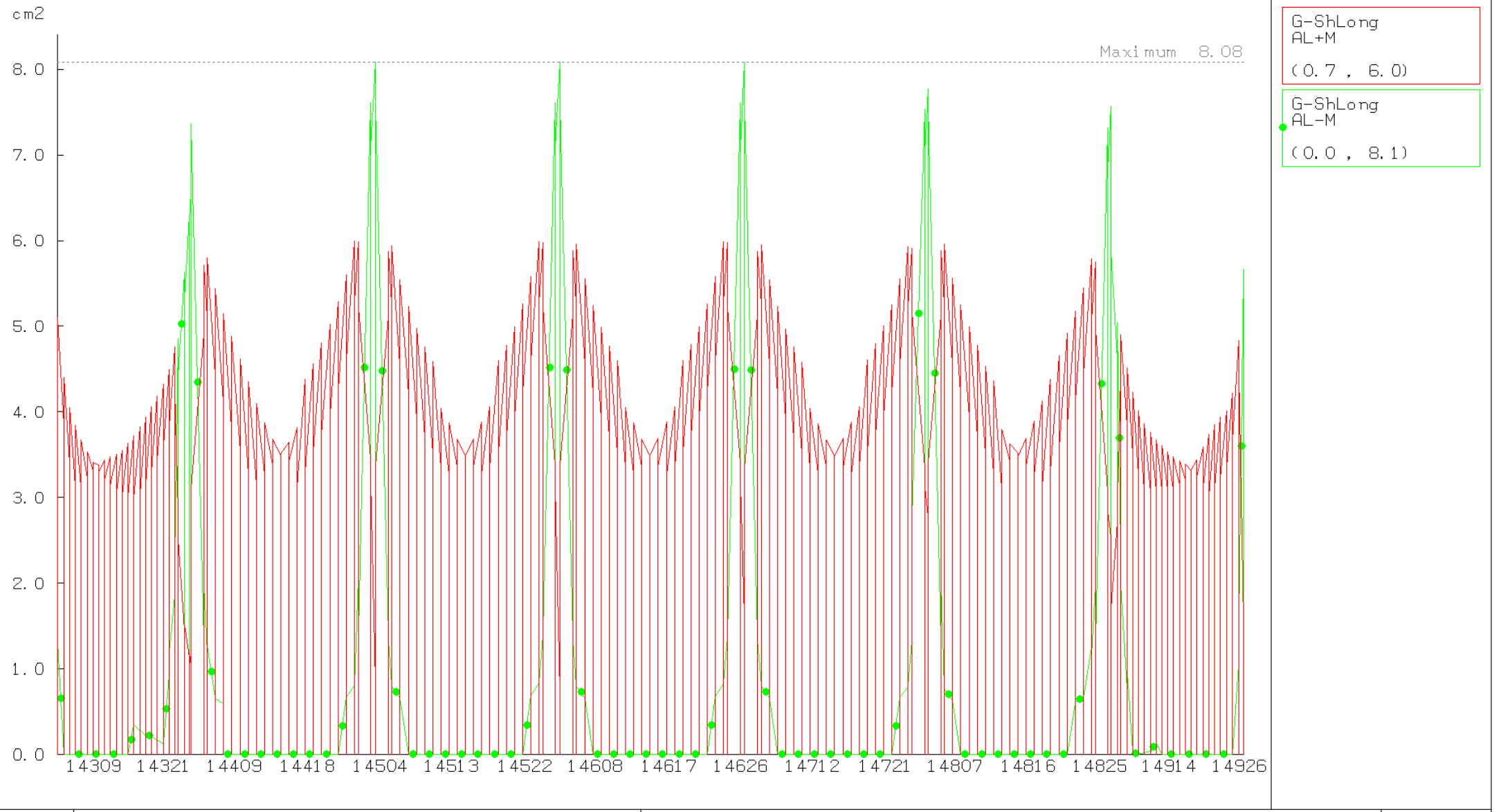
RmSet: 09-G7-ReinfLong, Stage: B9-Girder-reinf

1 cm Plot = 0.00377 cm2

(DefaultSchedule)/B9-G7-Long

0 0.00377 0.00753 0.01130 0.01507 0.01884

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 7, Part 1, REIN, Deck-BendS-T

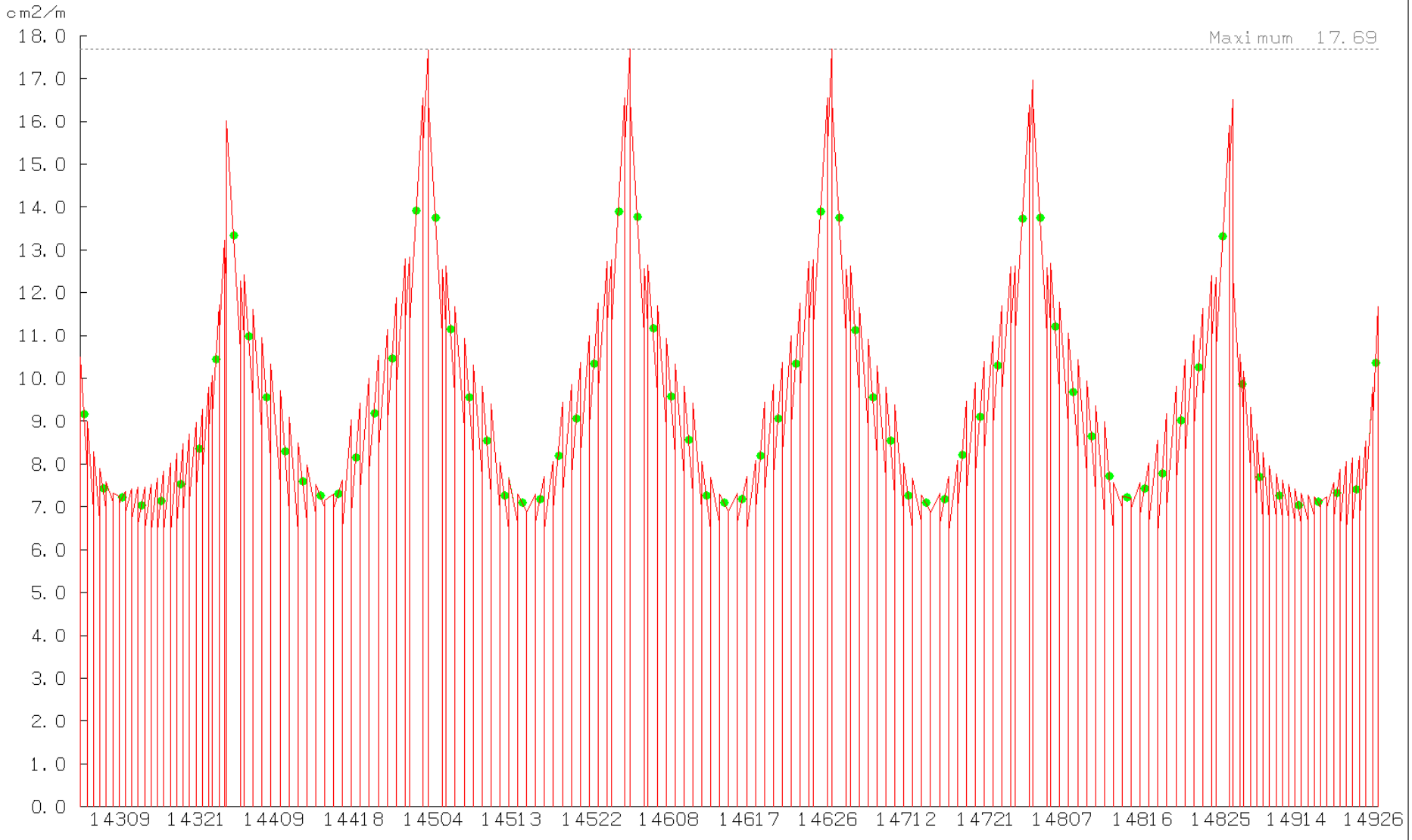
RmSet: 09-G7-ShearLong, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G7-ShLong

1 cm Plot = 0.640 cm2

0 0.640 1.280 1.920 2.560 3.201

19/07/2021
10:50



G-ShWeb
AVQ
(6.4 , 17.7)

G-ShWeb
AVQT
(6.4 , 17.7)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 7, Part 1, REIN, Deck-BendS-T

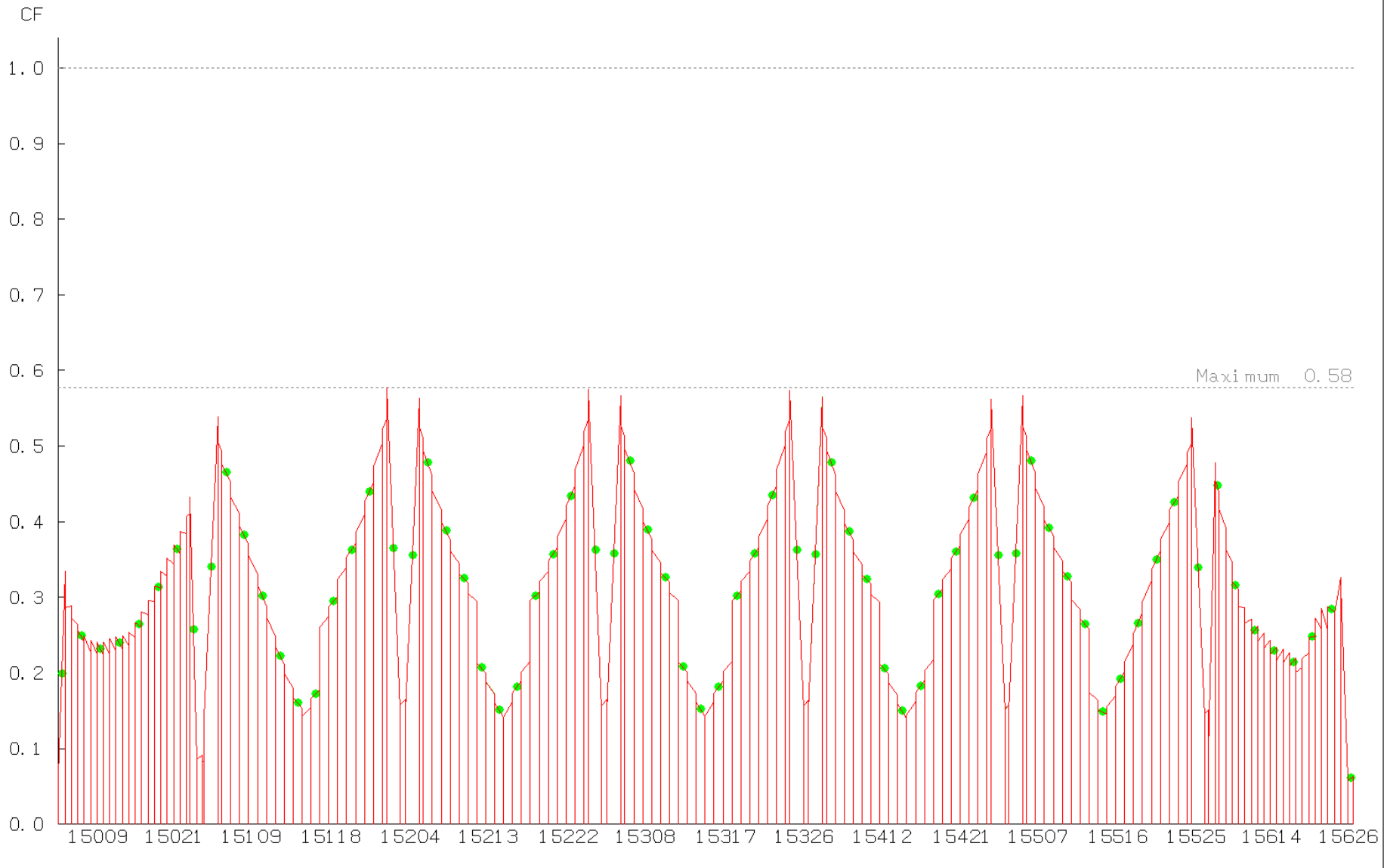
RmSet: 09-G7-ShearWeb, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G7-ShWeb

1 cm Plot = 1.401 cm2/m

0 1.401 2.802 4.202 5.603 7.004

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 8, Part 1, REIN, Deck-BendS-T

RmSet: 09-G8-CF, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G8-CF

1 cm Plot = 0.0792 CF

0 0.0792 0.1584 0.2376 0.3168 0.3960

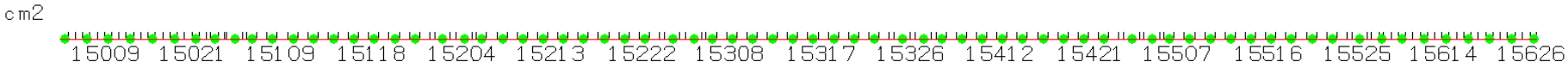
19/07/2021
10:50

LongG-B
AL

(0.0 , 0.0)

LongG-T
AL

(0.0 , 0.0)



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 8, Part 1, REIN, Deck-BendS-T

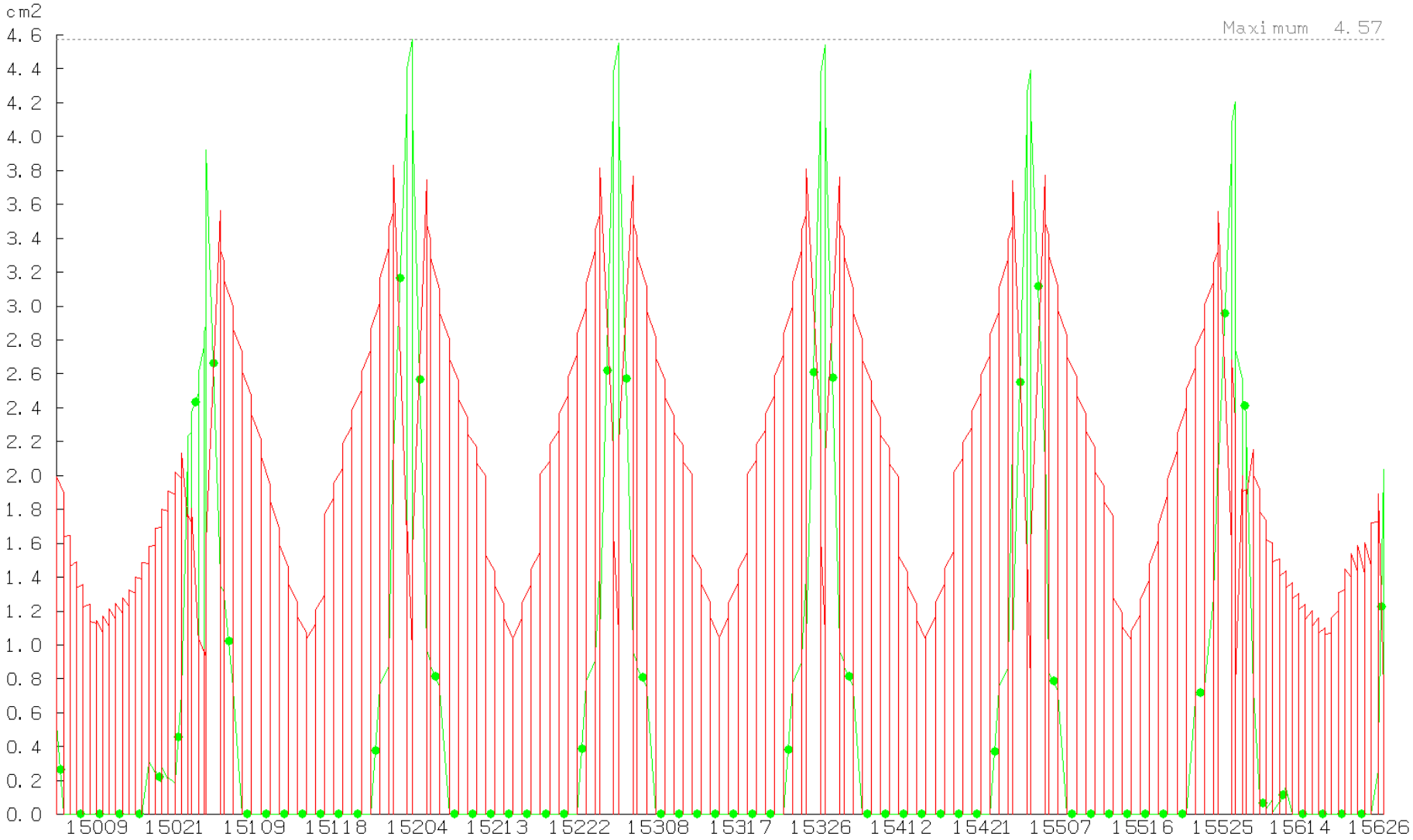
RmSet: 09-G8-ReinfLong, Stage: B9-Girder-reinf

1 cm Plot = 0.00377 cm2

(DefaultSchedule)/B9-G8-Long

0 0.00377 0.00753 0.01130 0.01507 0.01884

19/07/2021
10:50



G-ShLong
AL+M
(0.7 , 3.8)

G-ShLong
AL-M
(0.0 , 4.6)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 8, Part 1, REIN, Deck-BendS-T

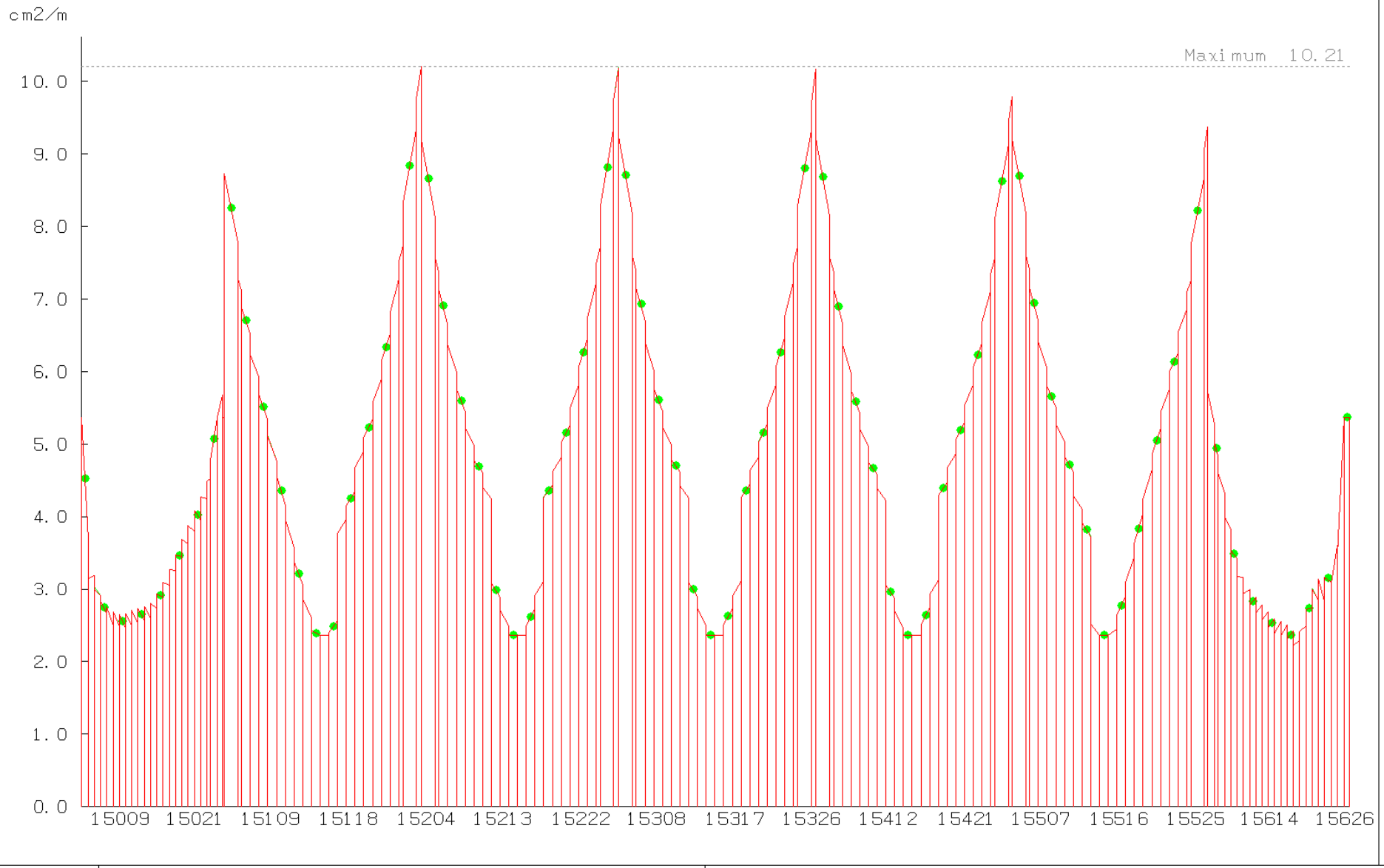
RmSet: 09-G8-ShearLong, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G8-ShLong

1 cm Plot = 0.362 cm2

0 0.362 0.724 1.087 1.449 1.811

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 8, Part 1, REIN, Deck-BendS-T

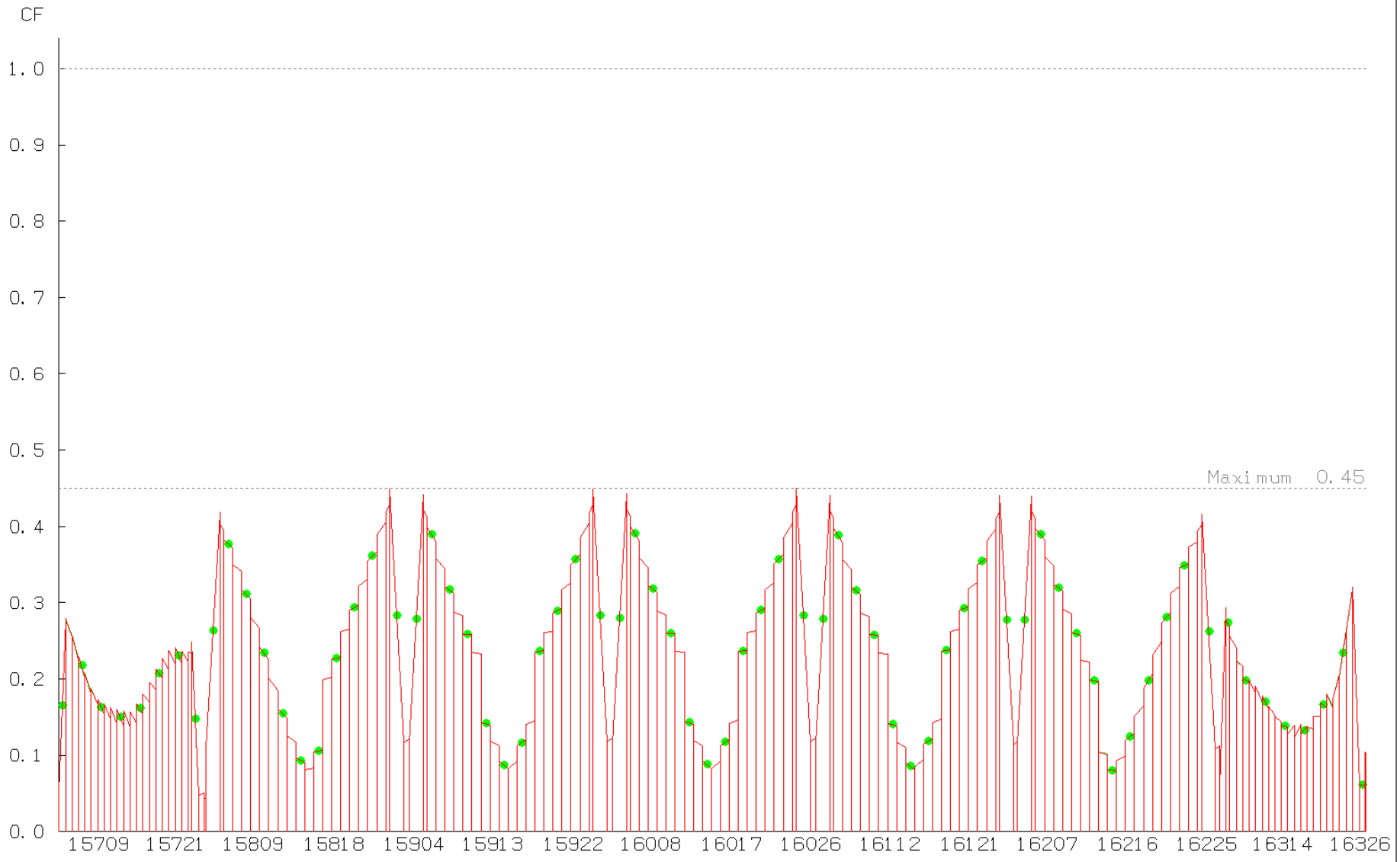
RmSet: 09-G8-ShearWeb, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G8-ShWeb

1 cm Plot = 0.809 cm2/m

0 0.809 1.617 2.426 3.234 4.043

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 9, Part 1, REIN, Deck-BendS-T

RmSet: 09-G9-CF, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G9-CF

1 cm Plot = 0.0792 CF

0 0.0792 0.1584 0.2376 0.3168 0.3960

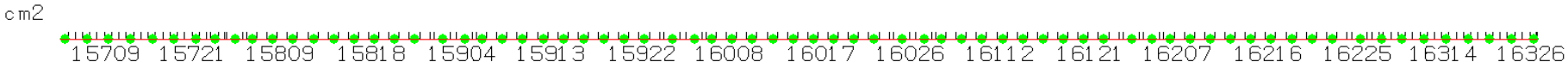
19/07/2021
10:50

LongG-B
AL

(0.0 , 0.0)

LongG-T
AL

(0.0 , 0.0)



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 9, Part 1, REIN, Deck-BendS-T

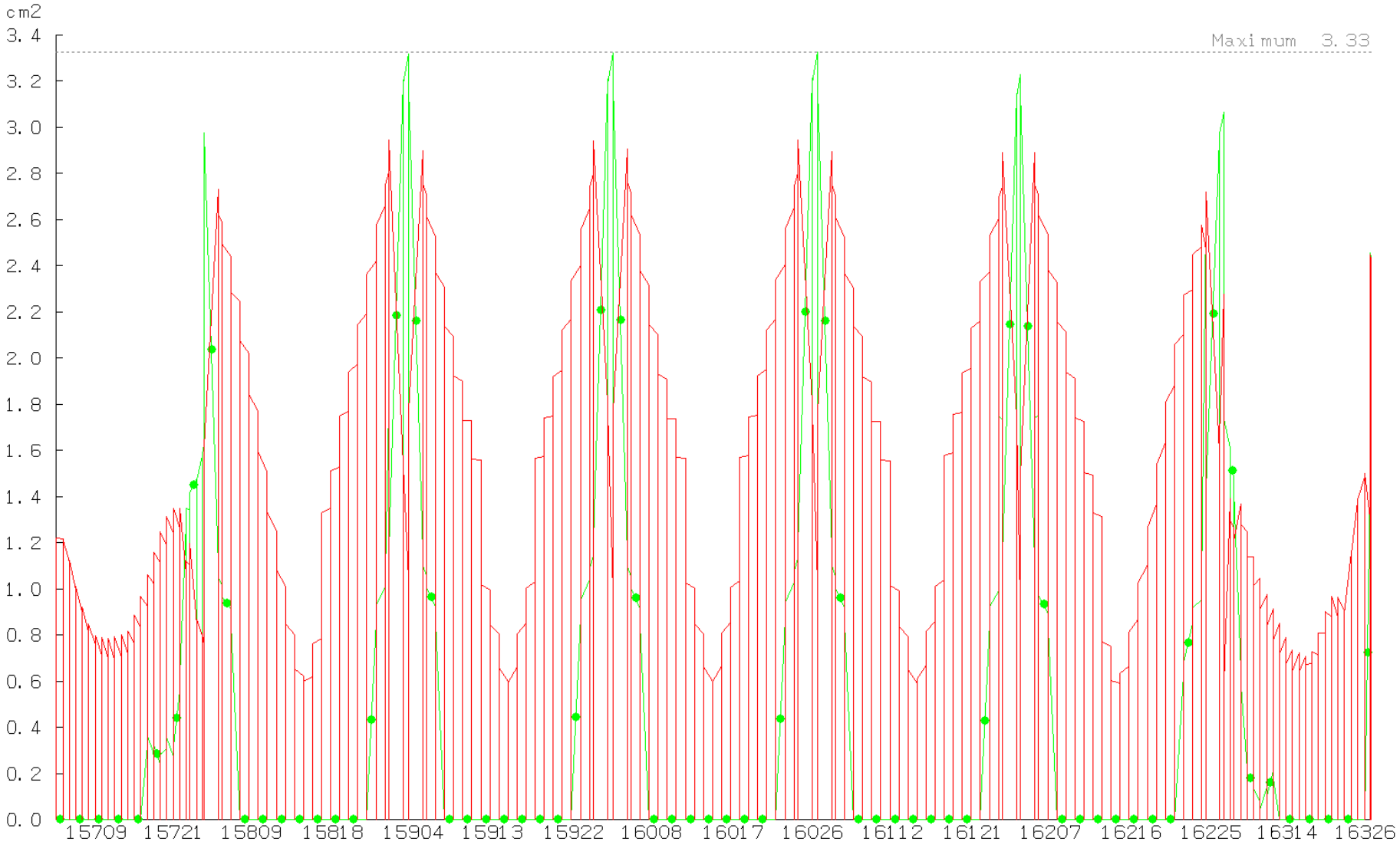
RmSet: 09-G9-ReinfLong, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G9-Long

1 cm Plot = 0.00377 cm2

0 0.00377 0.00753 0.01130 0.01507 0.01884

19/07/2021
10:50



G-ShLong
AL+M
(0.6 , 2.9)

G-ShLong
AL-M
(0.0 , 3.3)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 9, Part 1, REIN, Deck-BendS-T

RmSet: 09-G9-ShearLong, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G9-ShLong

1 cm Plot = 0.263 cm2

0 0.263 0.527 0.790 1.054 1.317

19/07/2021
10:50

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 9, Part 1, REIN, Deck-BendS-T

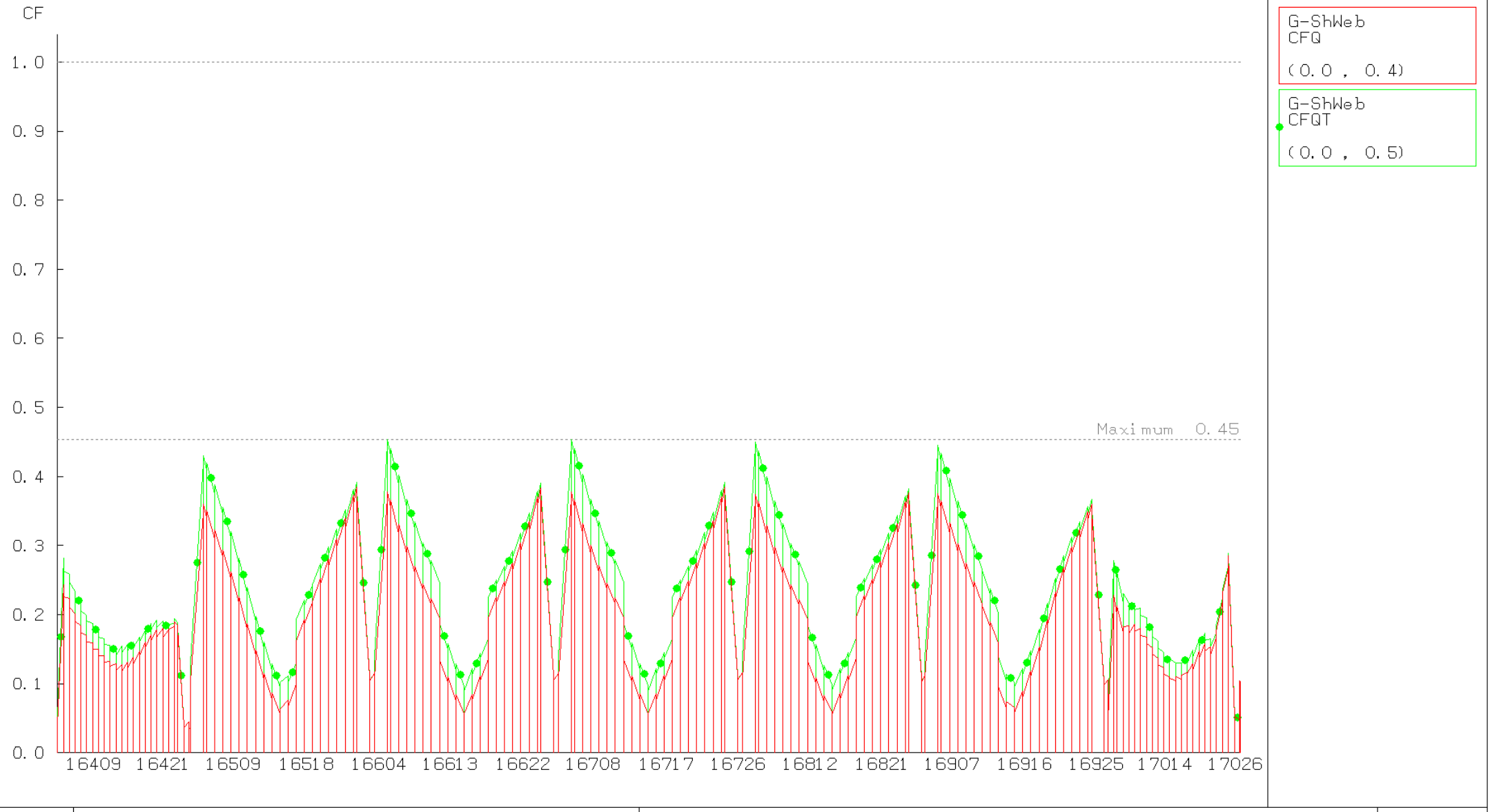
RmSet: 09-G9-ShearWeb, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G9-ShWeb

1 cm Plot = 0.601 cm2/m

0 0.601 1.202 1.804 2.405 3.006

19/07/2021
10:50



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 10, Part 1, REIN, Deck-BendS-T

RmSet: 09-G10-CF, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G10-CF

1 cm Plot = 0.0792 CF

0 0.0792 0.1584 0.2376 0.3168 0.3960

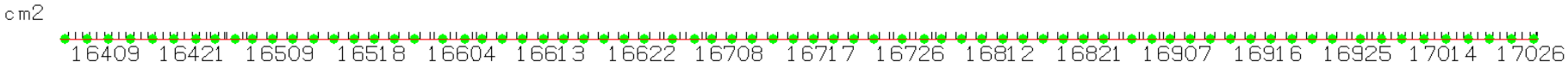
19/07/2021
10:50

LongG-B
AL

(0.0 , 0.0)

LongG-T
AL

(0.0 , 0.0)



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 10, Part 1, REIN, Deck-BendS-T

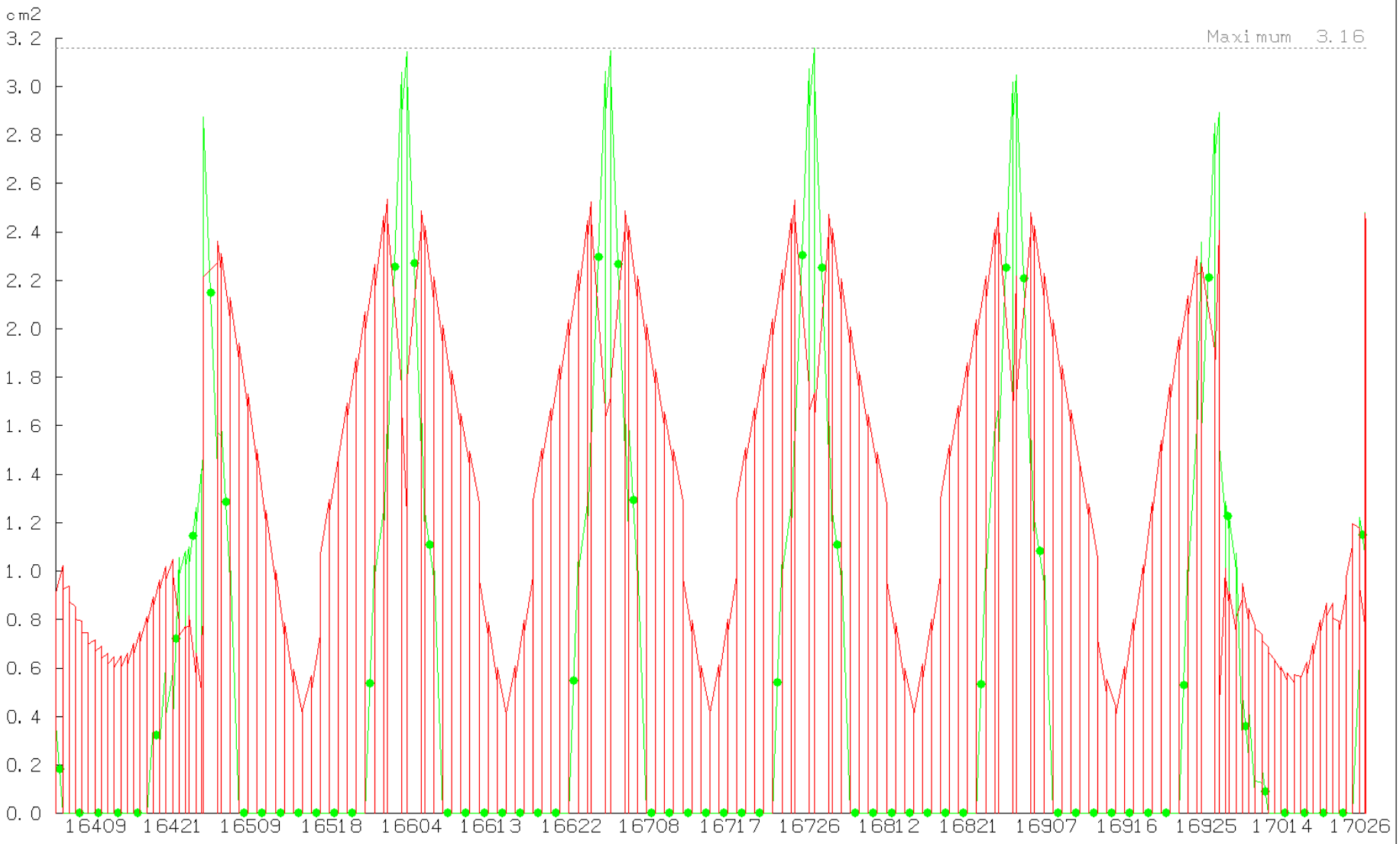
RmSet: 09-G10-ReinfLong, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G10-Long

1 cm Plot = 0.00377 cm2

0 0.00377 0.00753 0.01130 0.01507 0.01884

19/07/2021
10:50



G-ShLong
AL+M

(0.4 , 2.5)

G-ShLong
AL-M

(0.0 , 3.2)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 10, Part 1, REIN, Deck-BendS-T

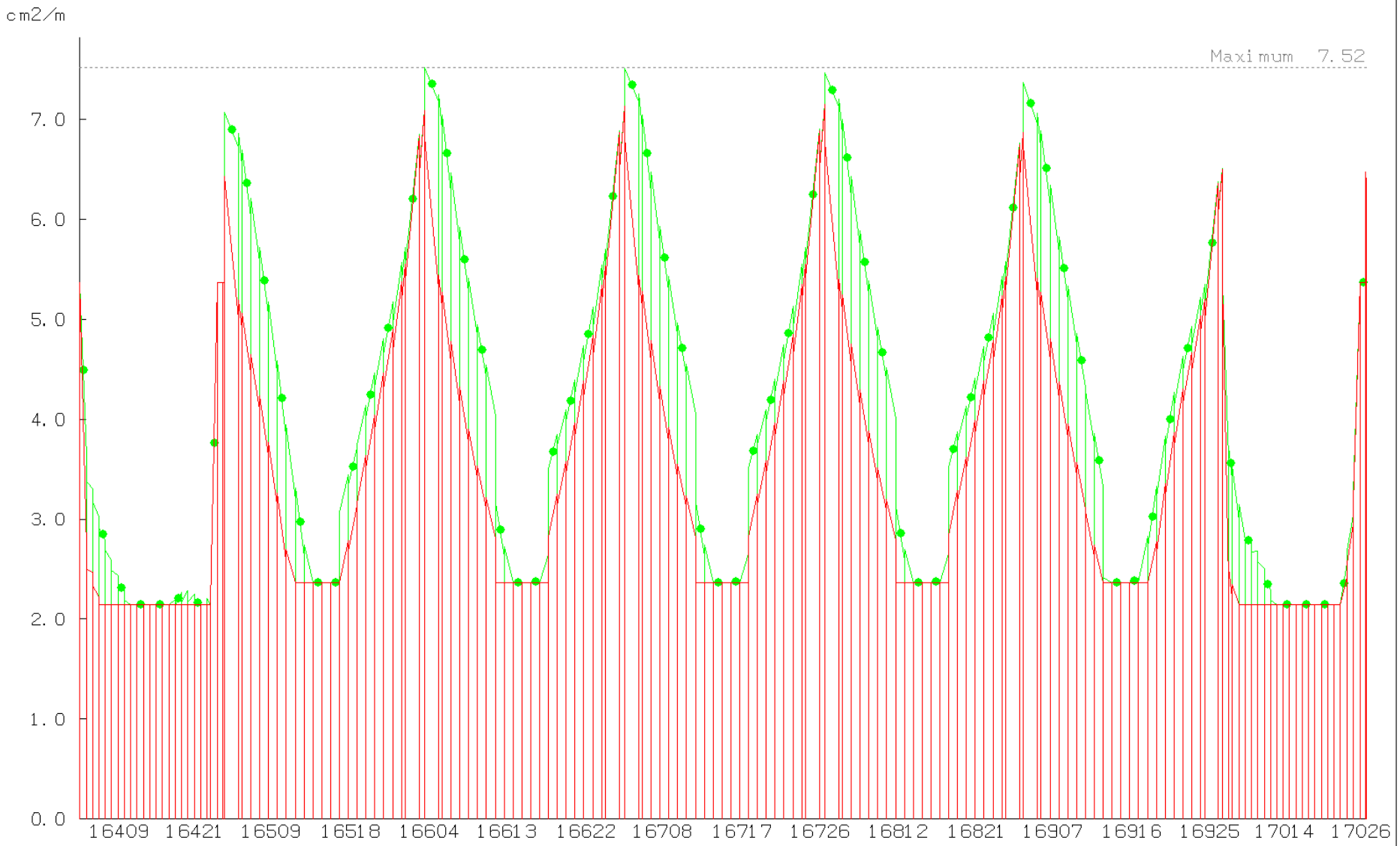
RmSet: 09-G10-ShearLong, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G10-ShLong

1 cm Plot = 0.250 cm2

0 0.250 0.500 0.751 1.001 1.251

19/07/2021
10:50



G-ShWeb
AVQ
(2.1 , 7.2)

G-ShWeb
AVQT
(2.1 , 7.5)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for AL, All Spans, Girder 10, Part 1, REIN, Deck-BendS-T

RmSet: 09-G10-ShearWeb, Stage: B9-Girder-reinf

(DefaultSchedule)/B9-G10-ShWeb

1 cm Plot = 0.596 cm2/m

0 0.596 1.191 1.787 2.382 2.978

19/07/2021
10:50

- **Потребна арматура** /Required reinforcement:

Подужна арматура /Longitudinal reinforcement:

$A_{a,min}=0.26*f_{ctm}/f_{yk} *b *d$

$A_{a,min}=0.26*3.8/500*50*0.9*90 = 8.0\ cm^2$

$A_{, req} = 9.50\ cm^2$

Смичућа арматура /Shear reinforcement:

$A_a=20.6\ cm^2$ (**код ослонца** /near pier)

$A_a=10.20\ cm^2$ (**у пољу** /in span middle)

- **Усвојена арматура** /Provided reinforcement:

Подужна арматура /Longitudinal reinforcement:

У пољу/Span:

Доња зона/bottom zone: 6Ø14 (Aa=9.24 cm2)

Горња зона/upper zone: 10Ø10 (Aa=7.85 cm2)

Над ослонцем/At pier:

Доња зона/bottom zone: 6Ø14 (Aa=9.24 cm2)

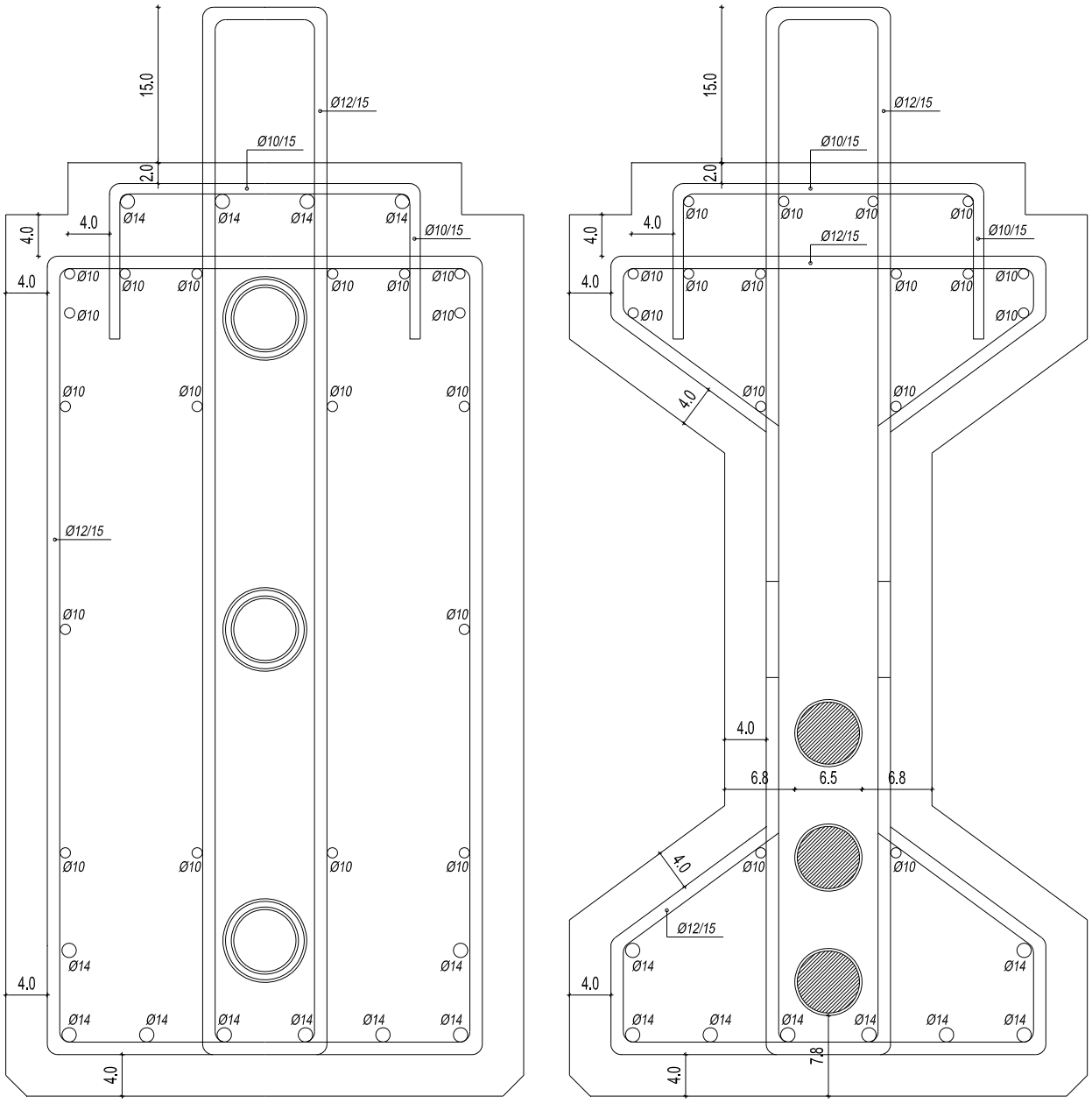
Горња зона/upper zone: 4Ø14+6Ø10 (Aa=10.87 cm2)

Смичућа арматура /Shear reinforcement:

Пресек у пољу/in span: U Ø12/15 (Aa=15.07 cm2)

Пресек код ослонца/at pier: 2U Ø12/15, m=4 (Aa=30.14 cm2)

Шема арматуре / reinforcement scheme

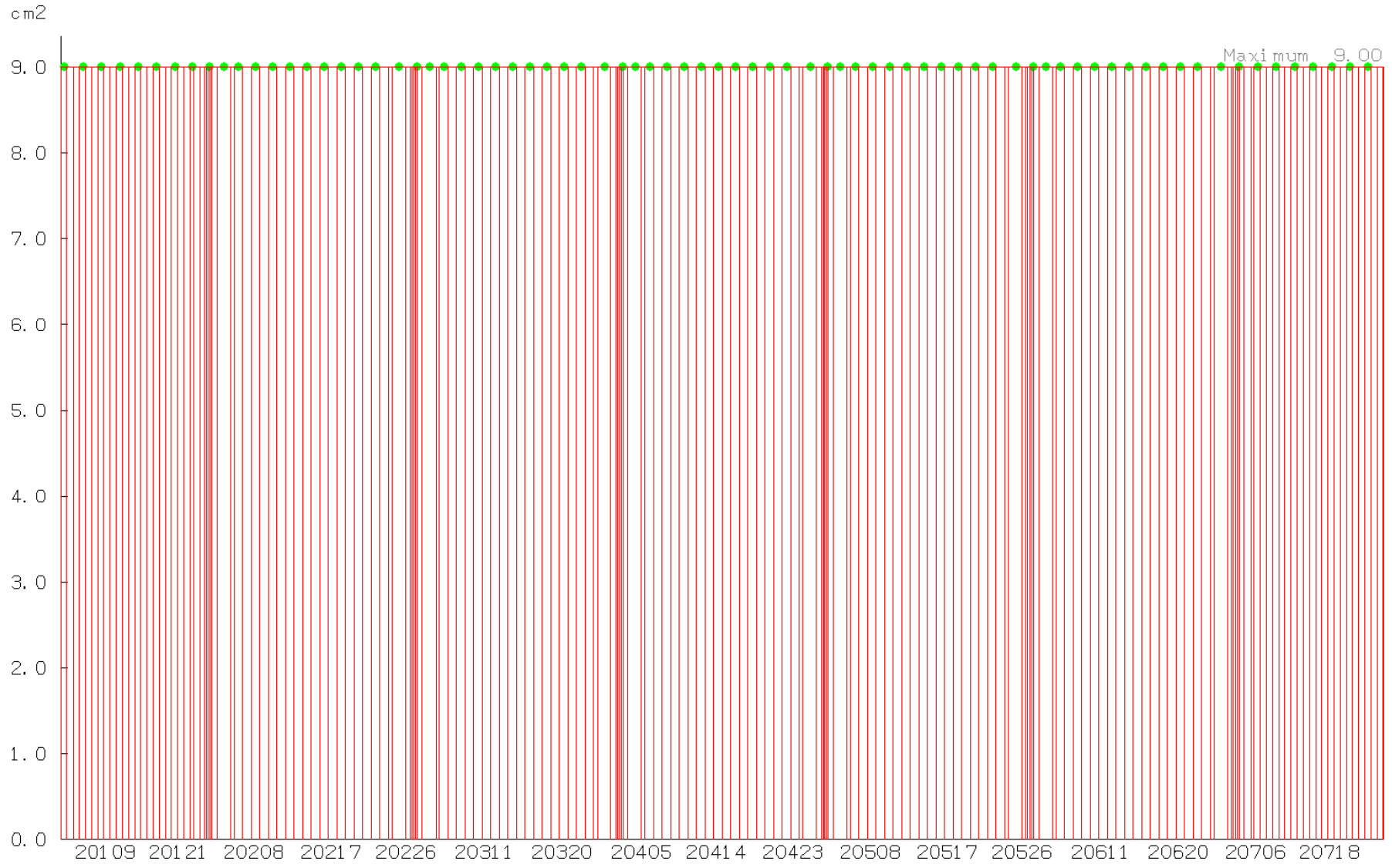


4.4.3.2 Прорачун арматуре у плочи

Deck slab reinforcing steel

ЛЕГЕНДА ДИЈАГРАМА АРМАТУРЕ /LEGEND

LongS-B - **Подужна арматура у плочи у доњој зони** /bottom zone deck reinforcement
LongS-T - **Подужна арматура у плочи у горњој зони** /top zone deck reinforcement



LongS-T
AL
(9.0 , 9.0)

LongS-B
AL
(9.0 , 9.0)

Author: DB Inzenjering , Beograd

Project: 95+739

RM Bridge Advanced CONNECT Edition
10.01.00.02

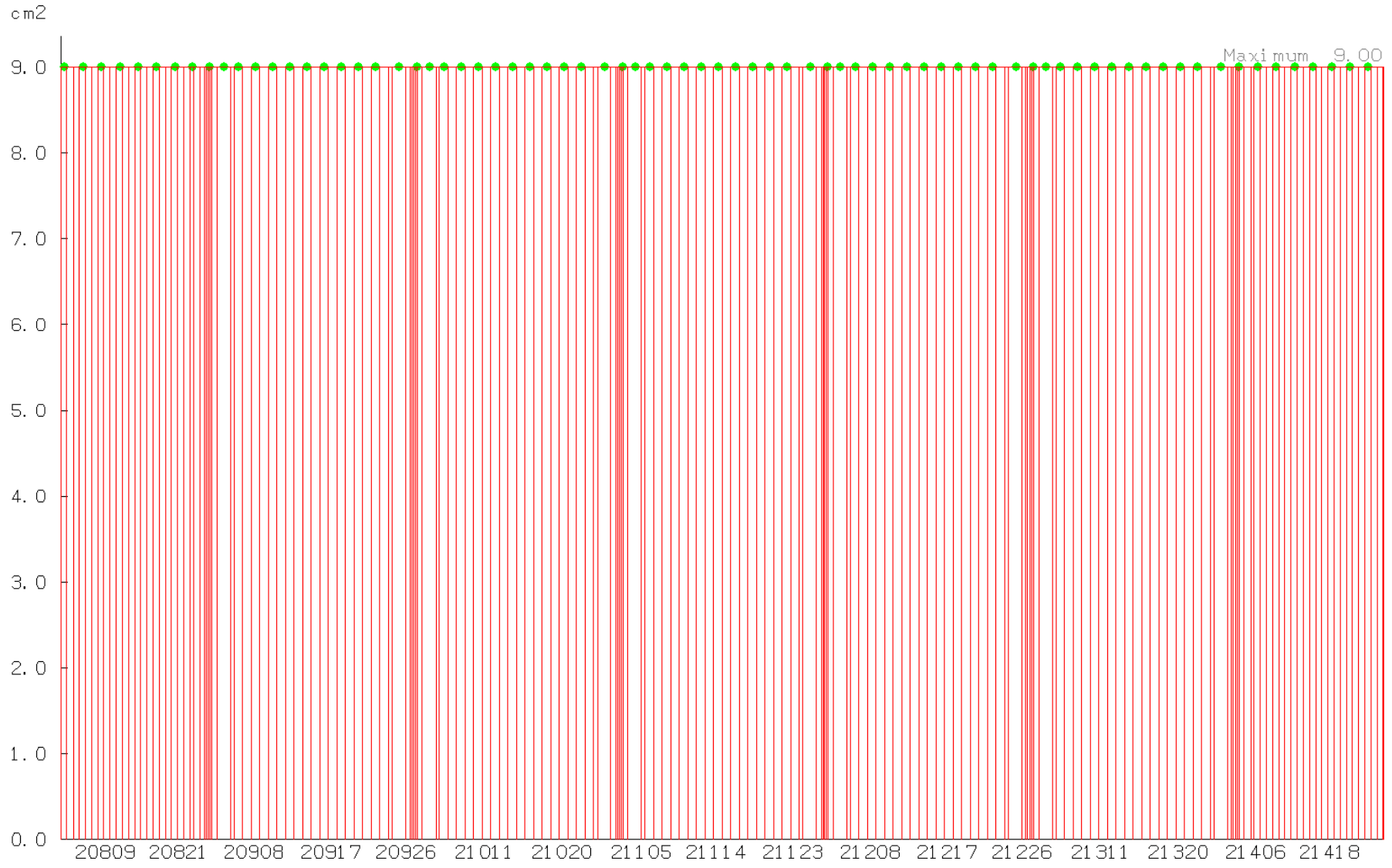
RmSet: Slab1, Stage: B10-SlabLong

(DefaultSchedule)/B10-SlabLong1

1 cm Plot = 0.713 cm2

0 0.713 1.426 2.139 2.851 3.564

19/07/2021
10:50



LongS-T
AL
(9.0 , 9.0)

LongS-B
AL
(9.0 , 9.0)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

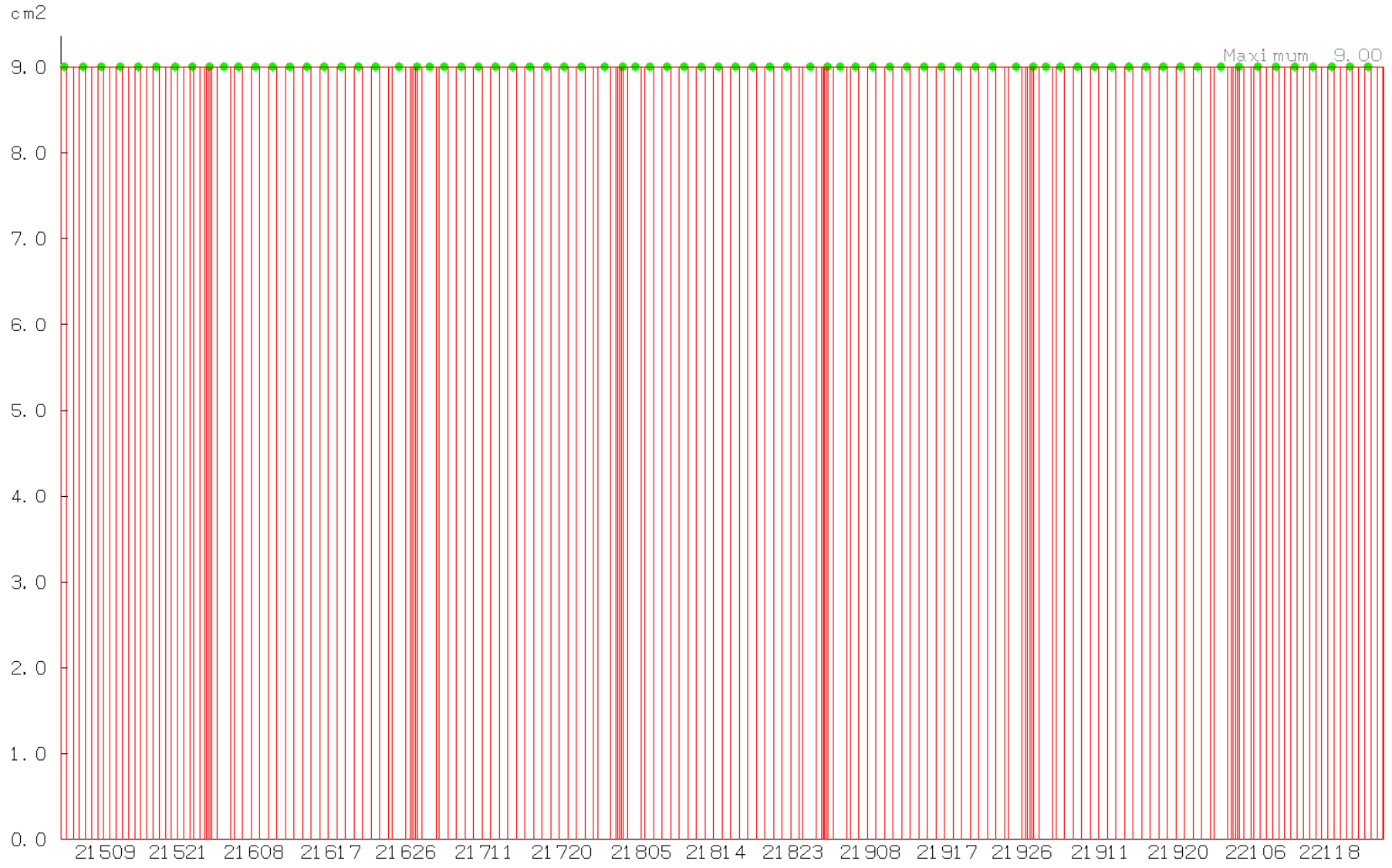
RmSet: Slab2, Stage: B10-SlabLong

(DefaultSchedule)/B10-SlabLong2

1 cm Plot = 0.713 cm2

0 0.713 1.426 2.139 2.851 3.564

19/07/2021
10:50



LongS-T
AL
(9.0 , 9.0)

LongS-B
AL
(9.0 , 9.0)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

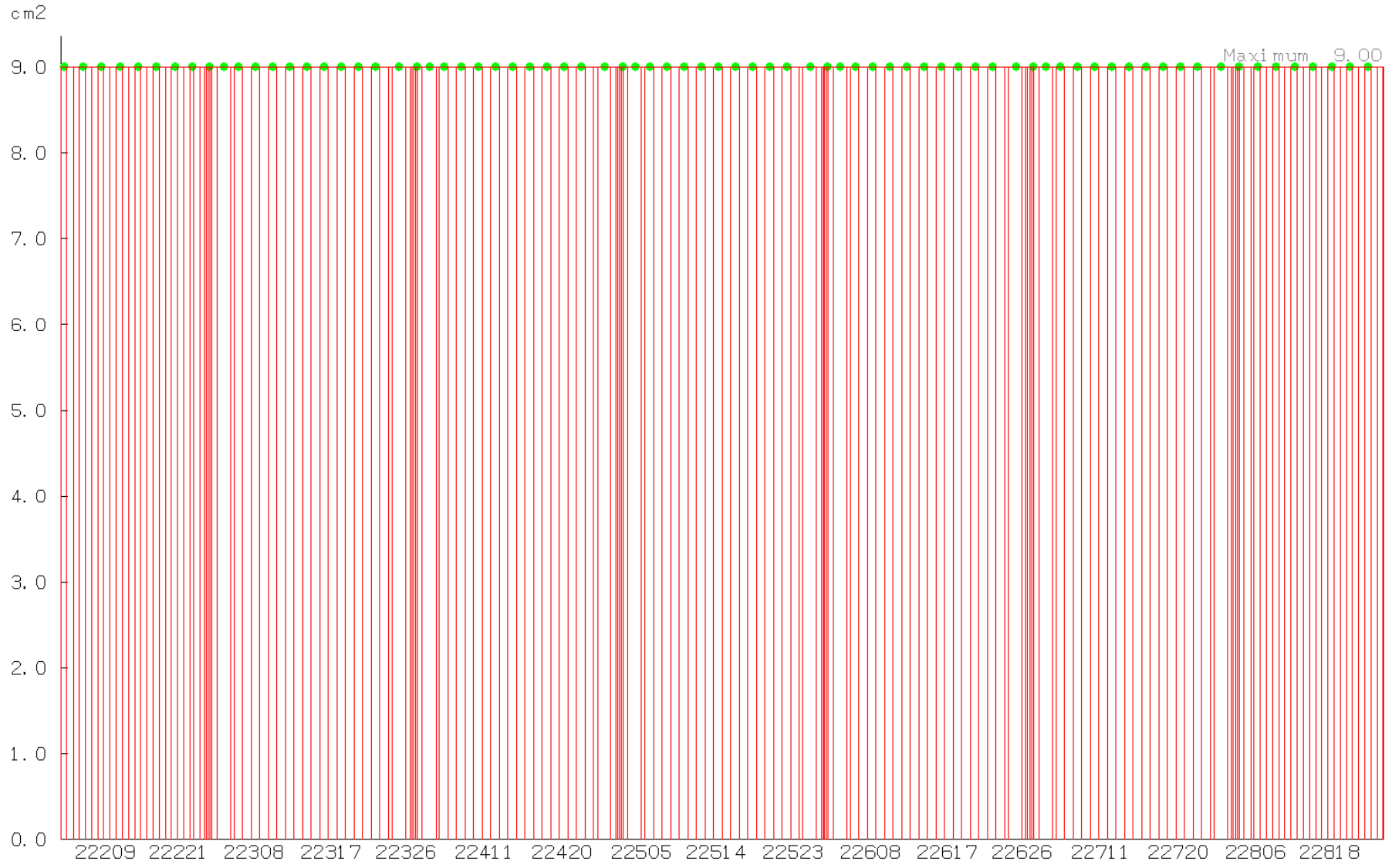
RmSet: Slab3, Stage: B10-SlabLong

(DefaultSchedule)/B10-SlabLong3

1 cm Plot = 0.713 cm2

0 0.713 1.426 2.139 2.851 3.564

19/07/2021
10:50



LongS-T
AL
(9.0 , 9.0)

LongS-B
AL
(9.0 , 9.0)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

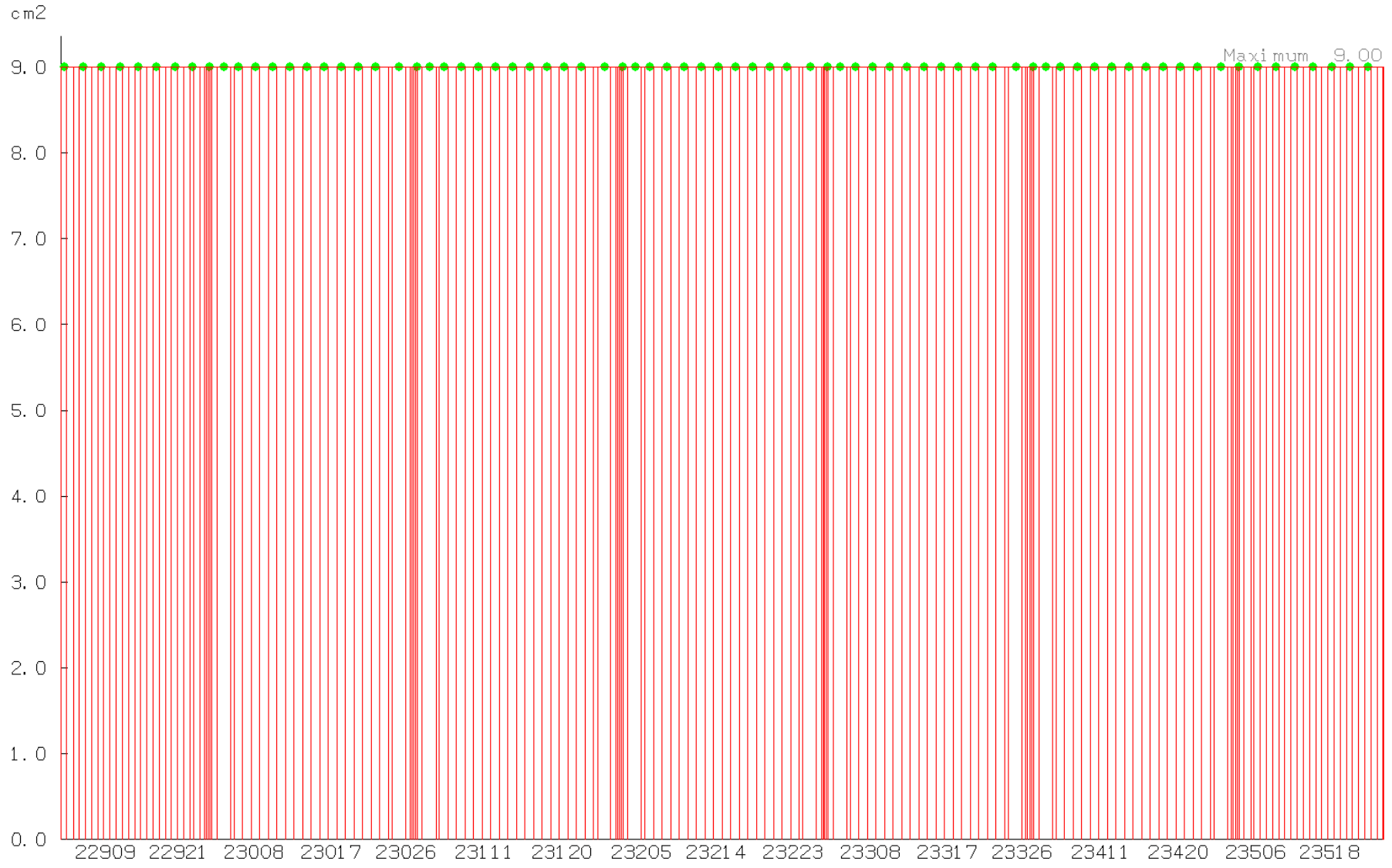
RmSet: Slab4, Stage: B10-SlabLong

(DefaultSchedule)/B10-SlabLong4

1 cm Plot = 0.713 cm2

0 0.713 1.426 2.139 2.851 3.564

19/07/2021
10:50



LongS-T
AL
(9.0 , 9.0)

LongS-B
AL
(9.0 , 9.0)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

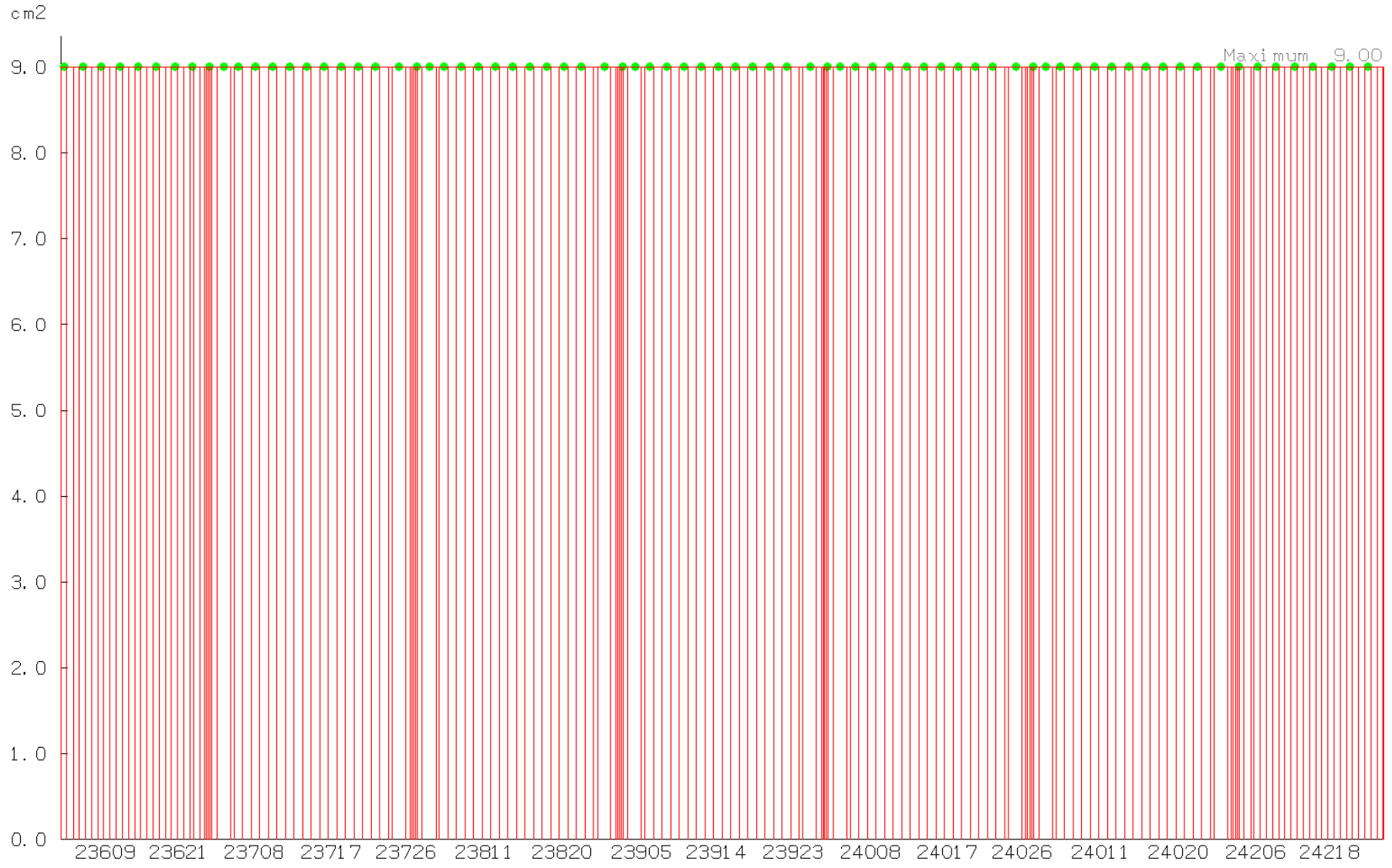
RmSet: Slab5, Stage: B10-SlabLong

(DefaultSchedule)/B10-SlabLong5

1 cm Plot = 0.713 cm2

0 0.713 1.426 2.139 2.851 3.564

19/07/2021
10:50



LongS-T
AL
(9.0 , 9.0)

LongS-B
AL
(9.0 , 9.0)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

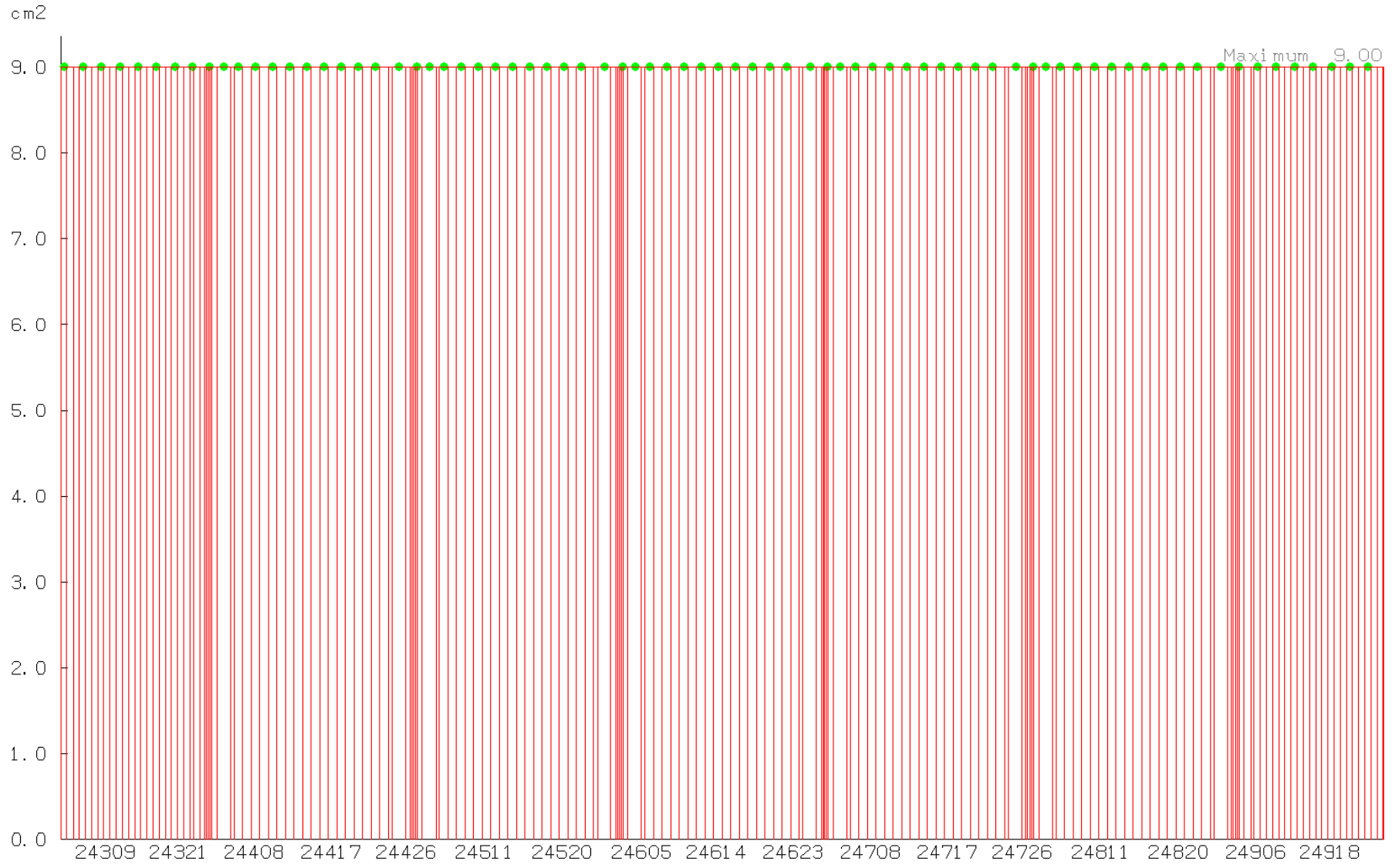
RmSet: Slab6, Stage: B10-SlabLong

(DefaultSchedule)/B10-SlabLong6

1 cm Plot = 0.713 cm2

0 0.713 1.426 2.139 2.851 3.564

19/07/2021
10:50



LongS-T
AL
(9.0 , 9.0)

LongS-B
AL
(9.0 , 9.0)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

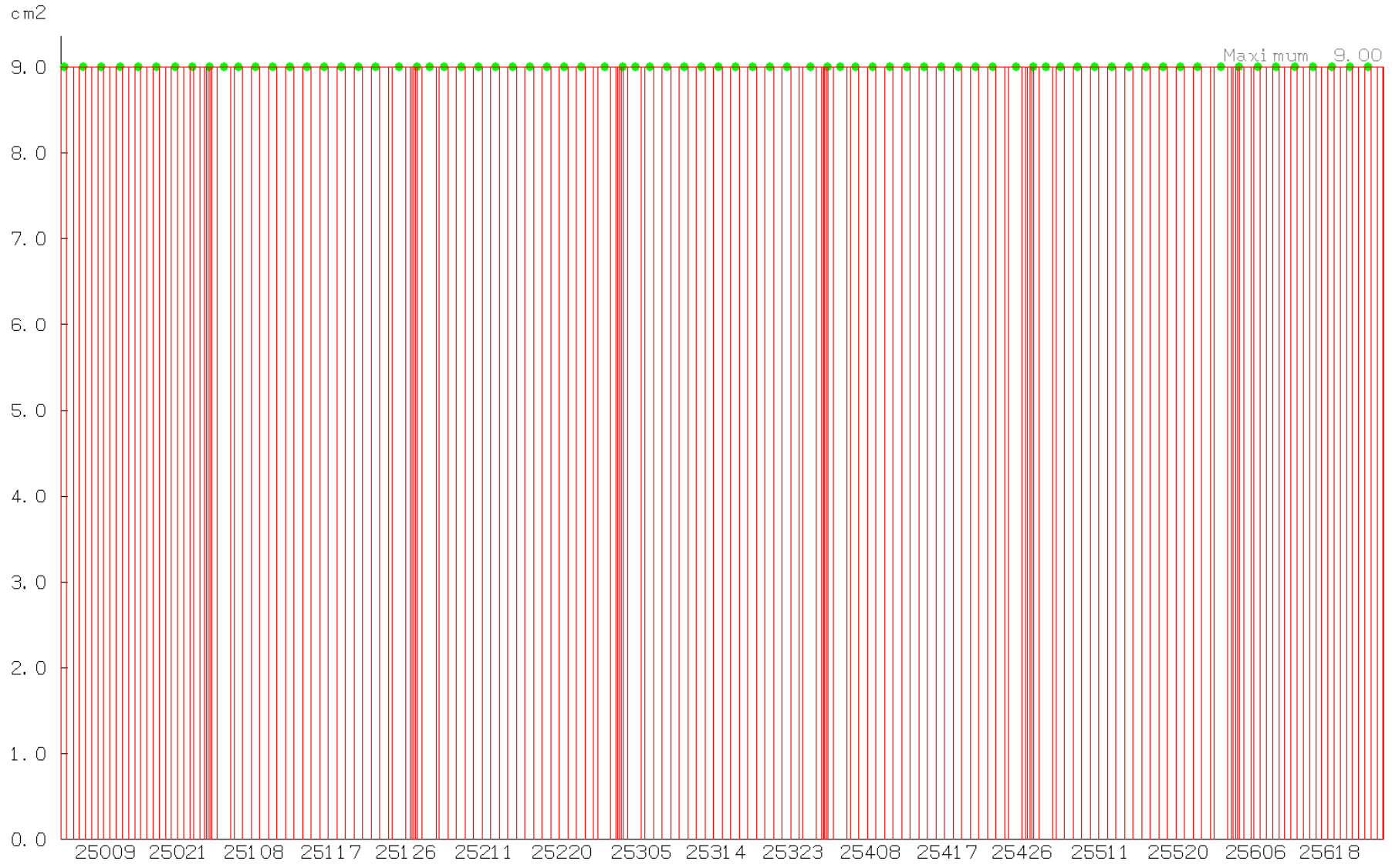
RmSet: Slab7, Stage: B10-SlabLong

(DefaultSchedule)/B10-SlabLong7

1 cm Plot = 0.713 cm2

0 0.713 1.426 2.139 2.851 3.564

19/07/2021
10:50



LongS-T
AL
(9.0 , 9.0)

LongS-B
AL
(9.0 , 9.0)

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: Slab8, Stage: B10-SlabLong

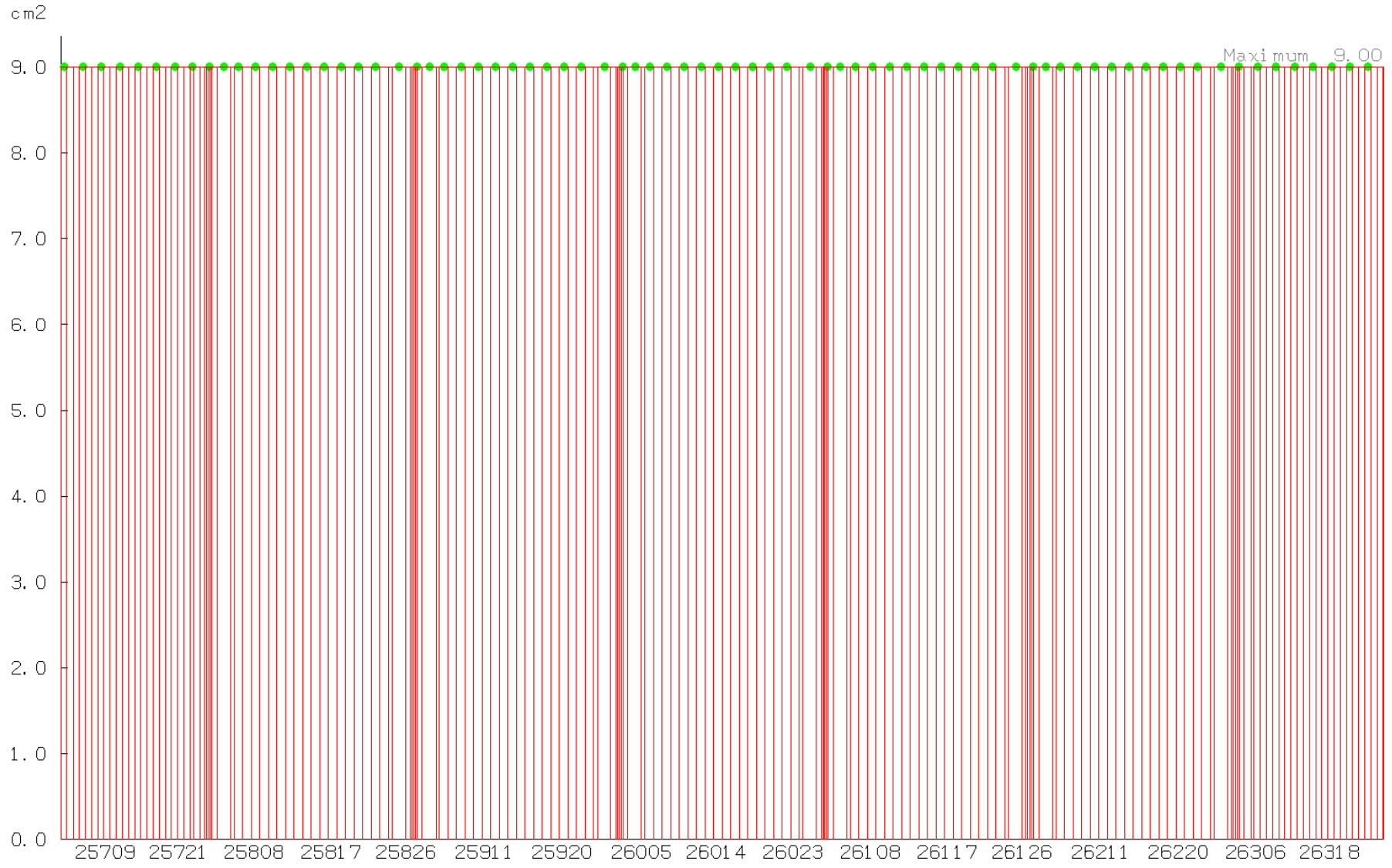
(DefaultSchedule)/B10-SlabLong8

1 cm Plot = 0.713 cm2

0 0.713 1.426 2.139 2.851 3.564

19/07/2021
10:50

RM Bridge Advanced CONNECT Edition
10.01.00.02



LongS-T
AL
(9.0 , 9.0)

LongS-B
AL
(9.0 , 9.0)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

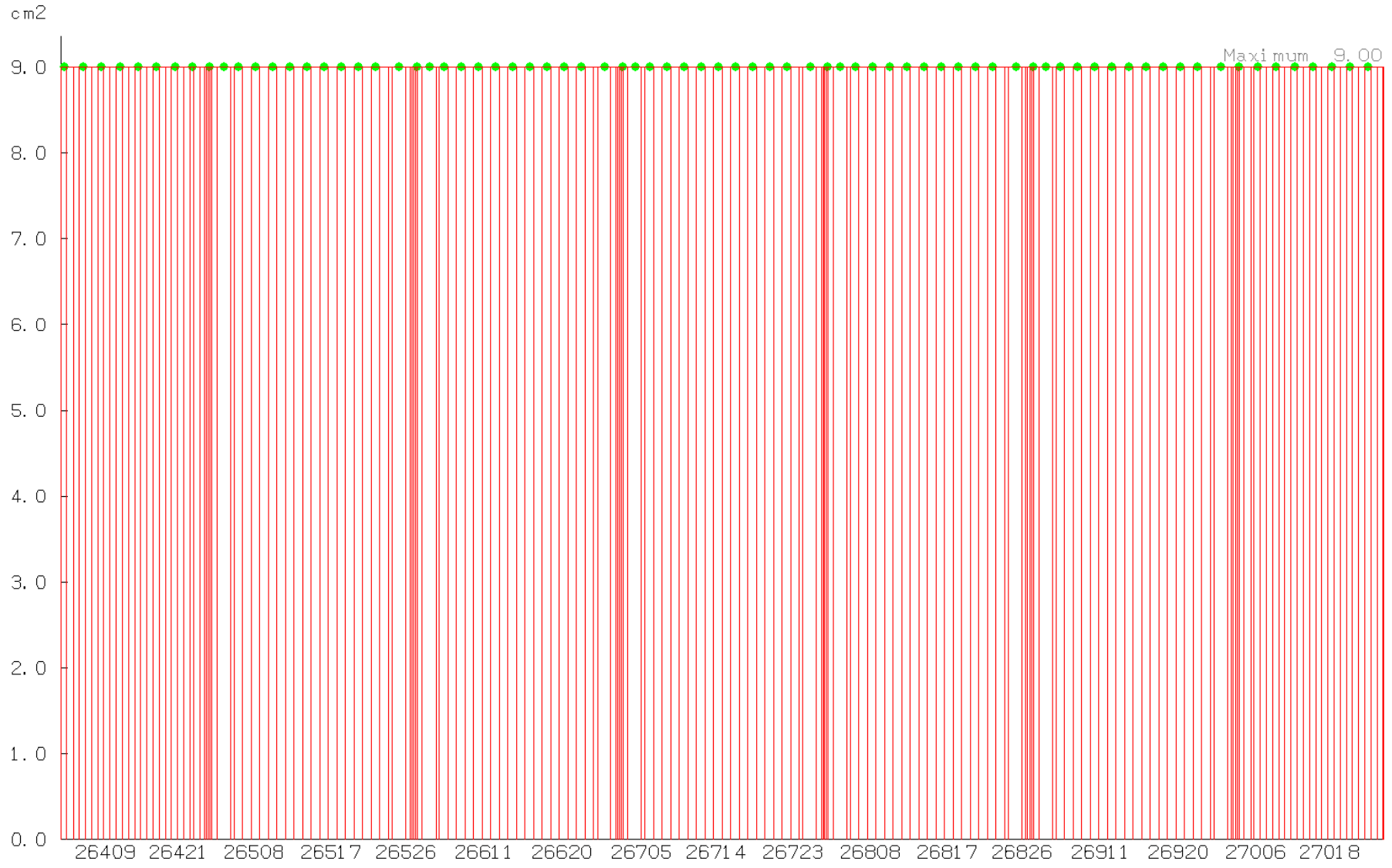
RmSet: Slab9, Stage: B10-SlabLong

(DefaultSchedule)/B10-SlabLong9

1 cm Plot = 0.713 cm2

0 0.713 1.426 2.139 2.851 3.564

19/07/2021
10:50



LongS-T
AL
(9.0 , 9.0)

LongS-B
AL
(9.0 , 9.0)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: Slab10, Stage: B10-SlabLong

(DefaultSchedule)/B10-SlabLong10

1 cm Plot = 0.713 cm2

0 0.713 1.426 2.139 2.851 3.564

19/07/2021
10:50

- **Потребна арматура** /Required reinforcement:

Подужна арматура /Longitudinal reinforcement:

Aa=31.50 cm2

Aa=31.5/0.90(припадајућа дужина /effective length)=35 cm2/m

- **Усвојена арматура** /Provided reinforcement:

Подужна арматура /Longitudinal reinforcement:

Пресек код ослонца/at pier**:**

Доња зона/bottom zone: Ø16 /15 (Aa=**13.40** cm^2)

Горња зона/top zone**:** Ø20/15 (Aa=**20.93** cm^2)

Пресек у пољу/middle span**:**

$\pm$ Ø14 /15 ($\pm$Aa=10.27 cm^2)

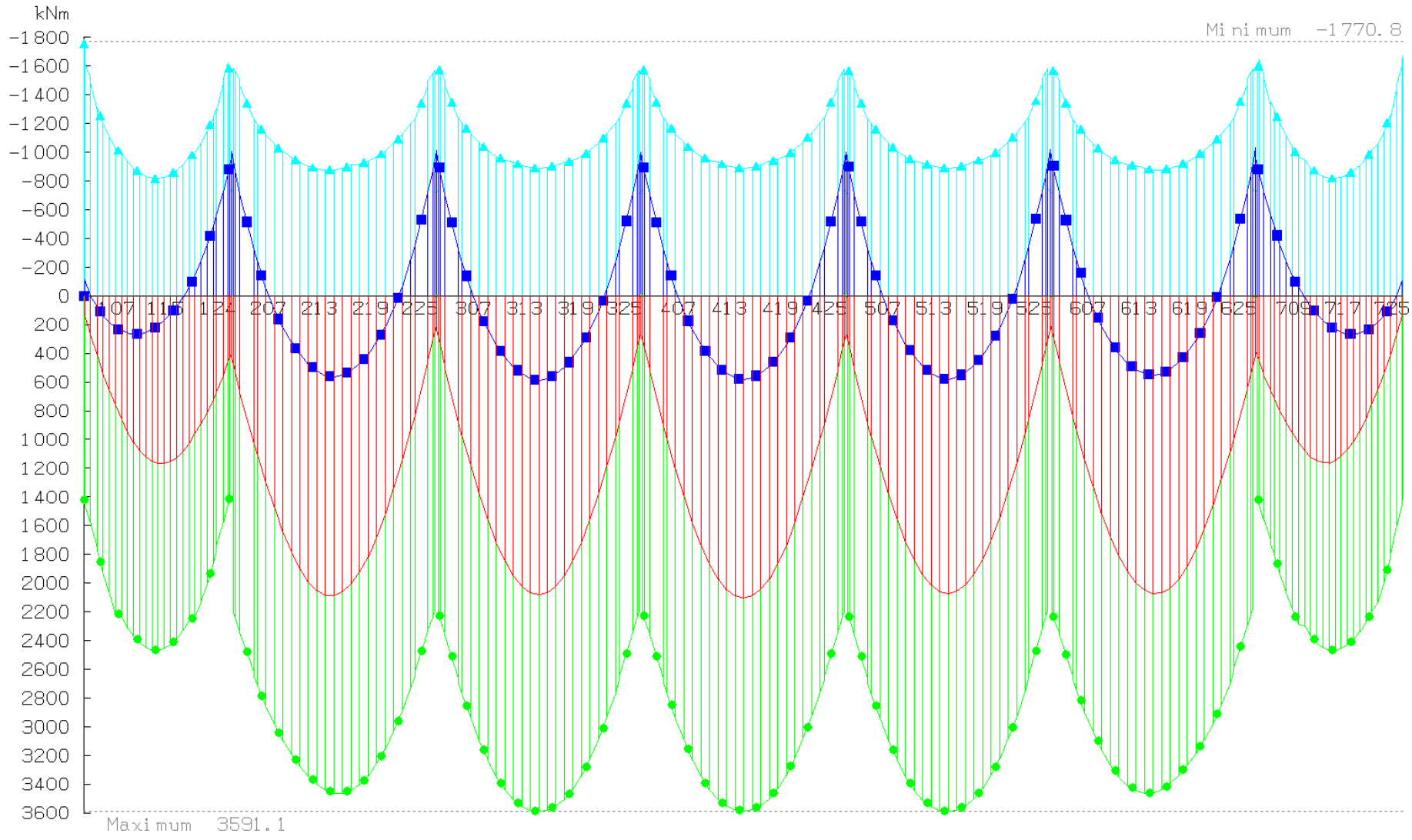
4.4.3.3 Носивост пресека – момент лома

Moment capacity at the ultimate limit state

ЛЕГЕНДА ДИЈАГРАМА МОМЕНАТА НОСИВОСТИ /LEGEND ULS CAPACITY

ULS.sup - **Максимална и минимална прорачунска вредност момента савијања за анвелопу комбинација ULS/**maximum and minimum value for calculated moments for ULS envelope

ULT-ULS.sup - **Максимална и минимална прорачунска носивост пресека за анвелопу комбинација ULS/**maximum and minimum resistance capacity of section for ULS envelope



ULS. sup
MaxMz: Mz
secondary: local: joined
(0 , 2104)

ULT-ULS. sup
MaxMz: Mz
secondary: local: joined
(-9 , 3591)

ULS. sup
MinMz: Mz
secondary: local: joined
(-1031 , 592)

ULT-ULS. sup
MinMz: Mz
secondary: local: joined
(-1771 , -709)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for MaxMz: Mz, All Spans, Girder 1, Part 3, MOMENT, ULS. sup

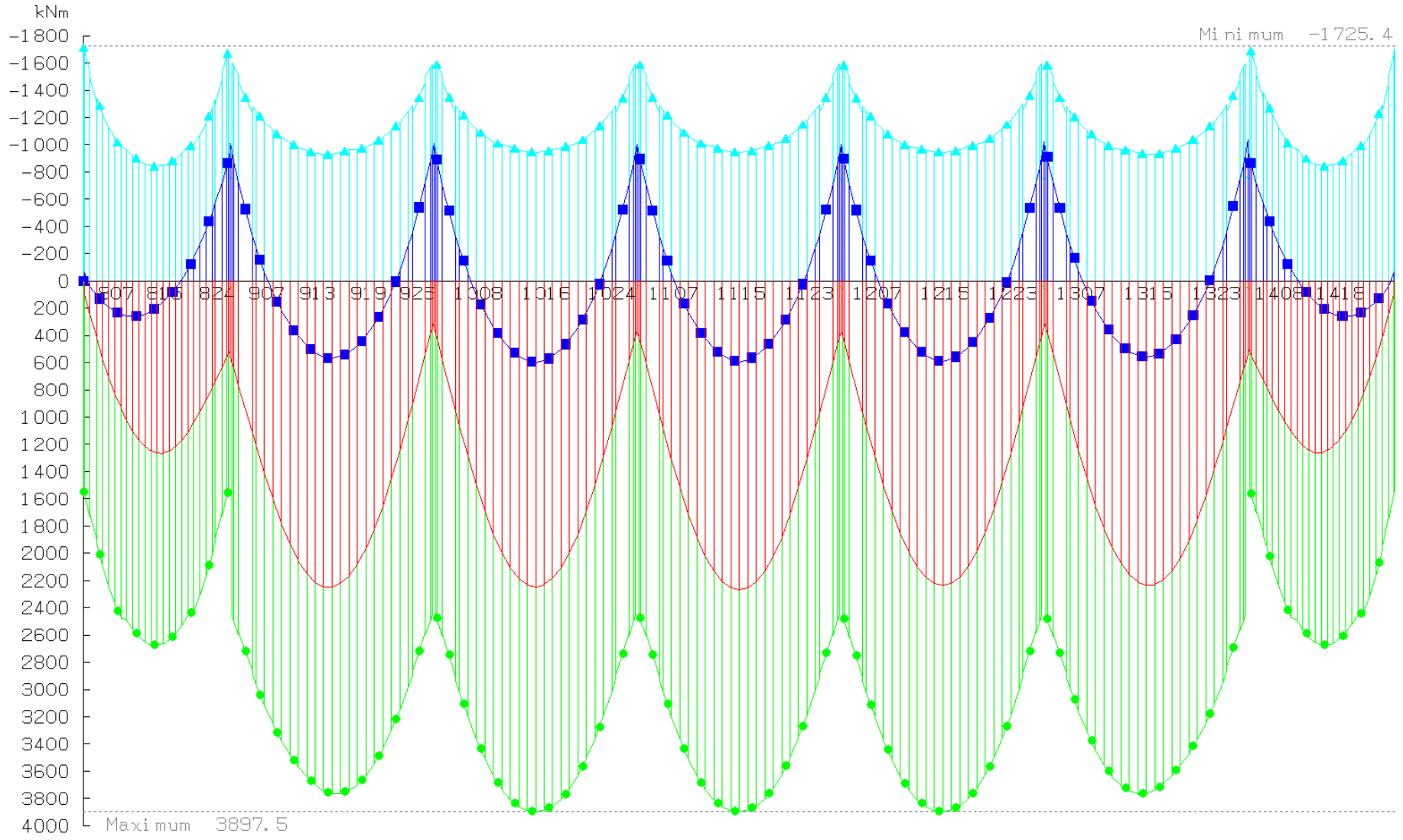
RmSet: BP-Ult-Comp, Stage: B11-Ult
Ultimate load carrying capacity

(DefaultSchedule)/BP-Ult-Comp

1 cm Plot = 424.7 kNm

0 424.7 849.4 1274.1 1698.8 2123.5

19/07/2021
10:50



ULS.sup
MaxMz: Mz
secondary: local: joined
(0 , 2271)

ULT-ULS.sup
MaxMz: Mz
secondary: local: joined
(37 , 3897)

ULS.sup
MinMz: Mz
secondary: local: joined
(-1037 , 602)

ULT-ULS.sup
MinMz: Mz
secondary: local: joined
(-1725 , -736)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for MaxMz: Mz, All Spans, Girder 2, Part 3, MOMENT, ULS.sup

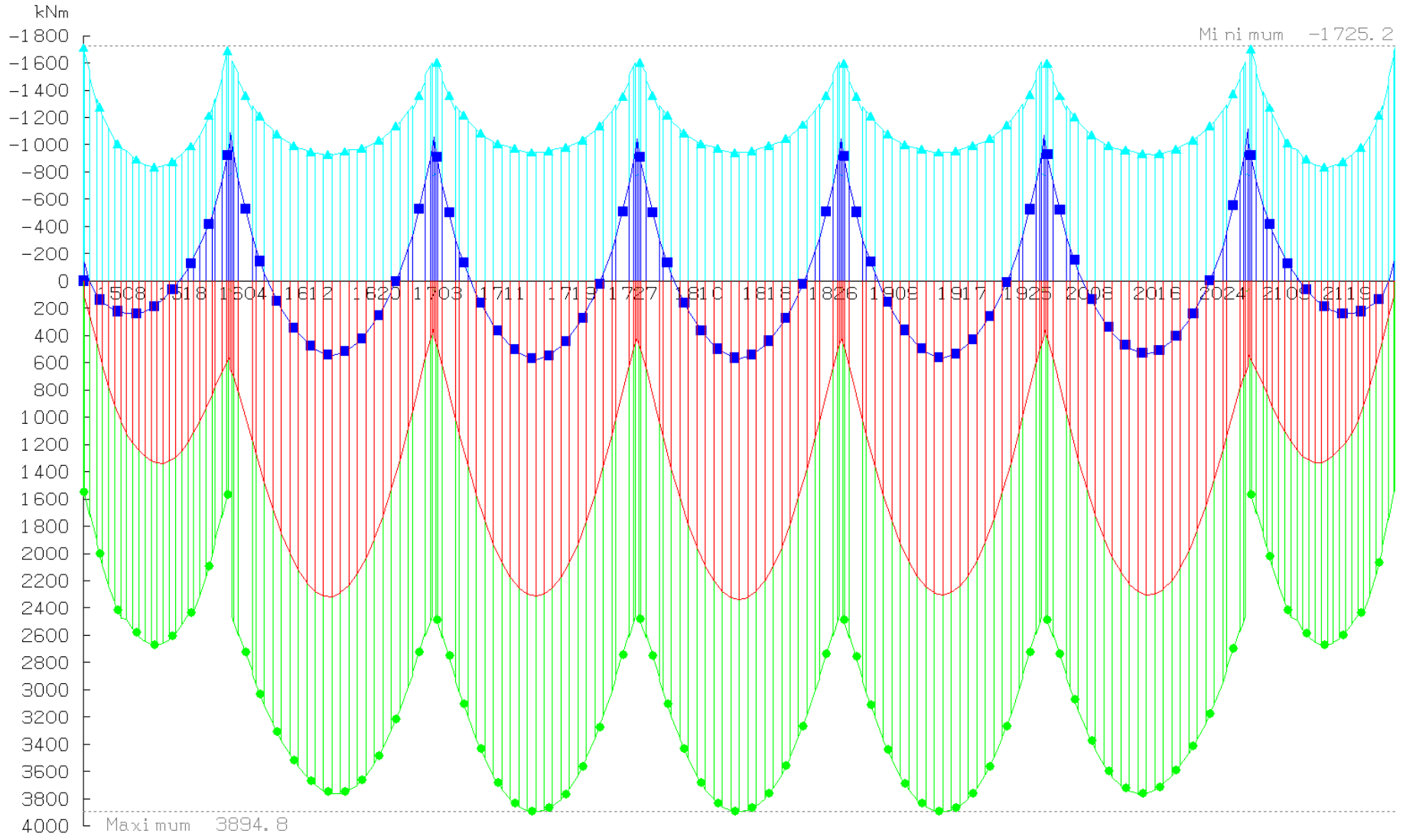
RmSet: BQ-Ult-Comp, Stage: B11-Ult
Ultimate load carrying capacity

(DefaultSchedule)/BQ-Ult-Comp

1 cm Plot = 445.4 kNm

0 445.4 890.7 1336.1 1781.5 2226.9

19/07/2021
10:50



ULS.sup
MaxMz: Mz
secondary: local: joined
(0 , 2337)

ULT-ULS.sup
MaxMz: Mz
secondary: local: joined
(54 , 3895)

ULS.sup
MinMz: Mz
secondary: local: joined
(-1115 , 576)

ULT-ULS.sup
MinMz: Mz
secondary: local: joined
(-1725 , -764)

Author: DB Inzenjering , Beograd

Project: 95+739

Results for MaxMz: Mz, All Spans, Girder 3, Part 3, MOMENT, ULS.sup

RmSet: BR-Ult-Comp, Stage: B11-Ult
Ultimate load carrying capacity

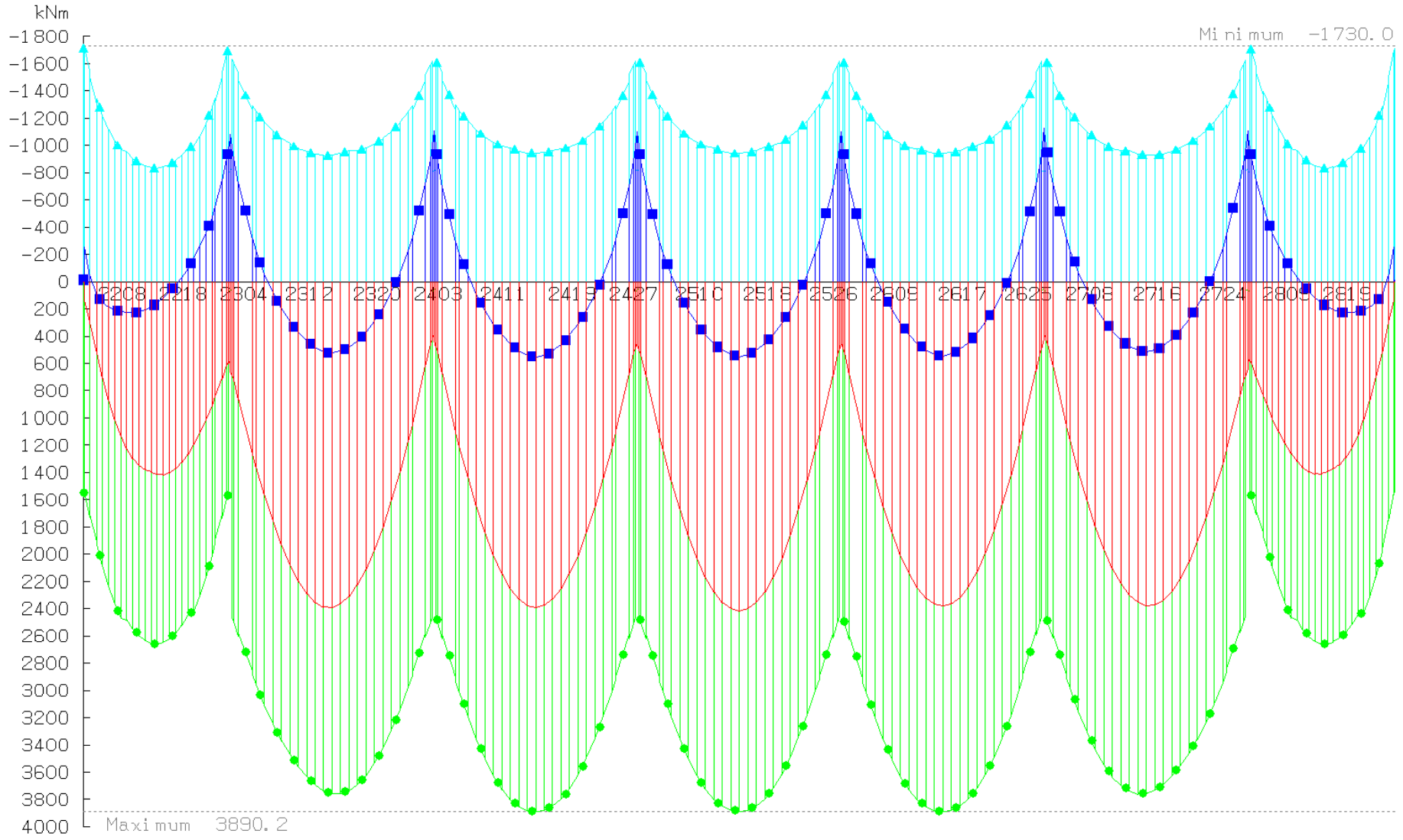
(DefaultSchedule)/BR-Ult-Comp

1 cm Plot = 445.2 kNm

0 445.2 890.3 1335.5 1780.6 2225.8

19/07/2021
10:50

RM Bridge Advanced CONNECT Edition
10.01.00.02



ULS.sup
MaxMz: Mz
secondary: local: joined
(0 , 2416)

ULT-ULS.sup
MaxMz: Mz
secondary: local: joined
(52 , 3890)

ULS.sup
MinMz: Mz
secondary: local: joined
(-1126 , 556)

ULT-ULS.sup
MinMz: Mz
secondary: local: joined
(-1730 , -803)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for MaxMz: Mz, All Spans, Girder 4, Part 3, MOMENT, ULS.sup

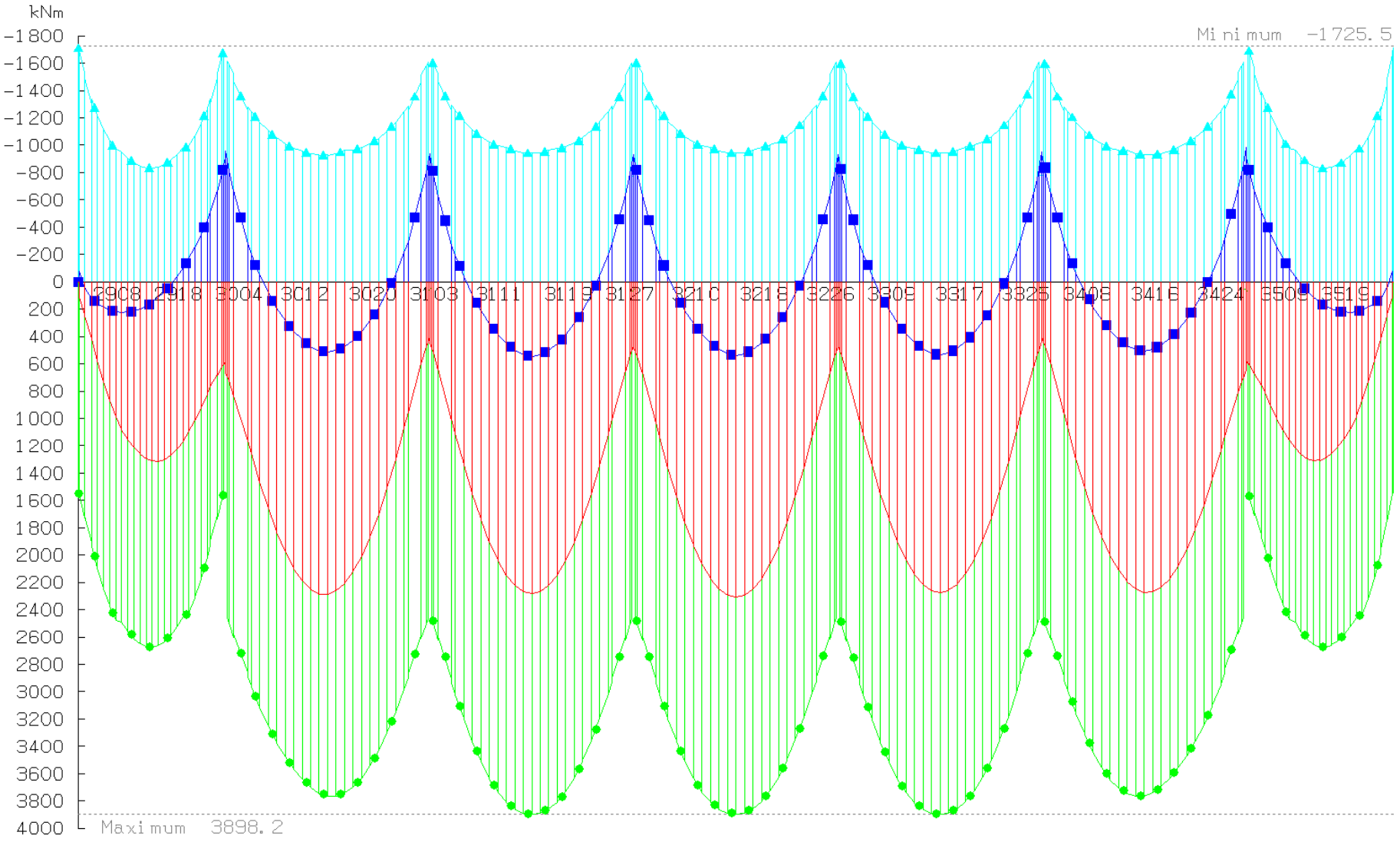
RmSet: BS-Ult-Comp, Stage: B11-Ult
Ultimate load carrying capacity

(DefaultSchedule)/BS-Ult-Comp

1 cm Plot = 445.2 kNm

0 445.2 890.3 1335.5 1780.7 2225.8

19/07/2021
10:51



ULS.sup
MaxMz: Mz
secondary: local: joined
(0 , 2308)

ULT-ULS.sup
MaxMz: Mz
secondary: local: joined
(47 , 3898)

ULS.sup
MinMz: Mz
secondary: local: joined
(-986 , 547)

ULT-ULS.sup
MinMz: Mz
secondary: local: joined
(-1725 , -773)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for MaxMz: Mz, All Spans, Girder 5, Part 3, MOMENT, ULS.sup

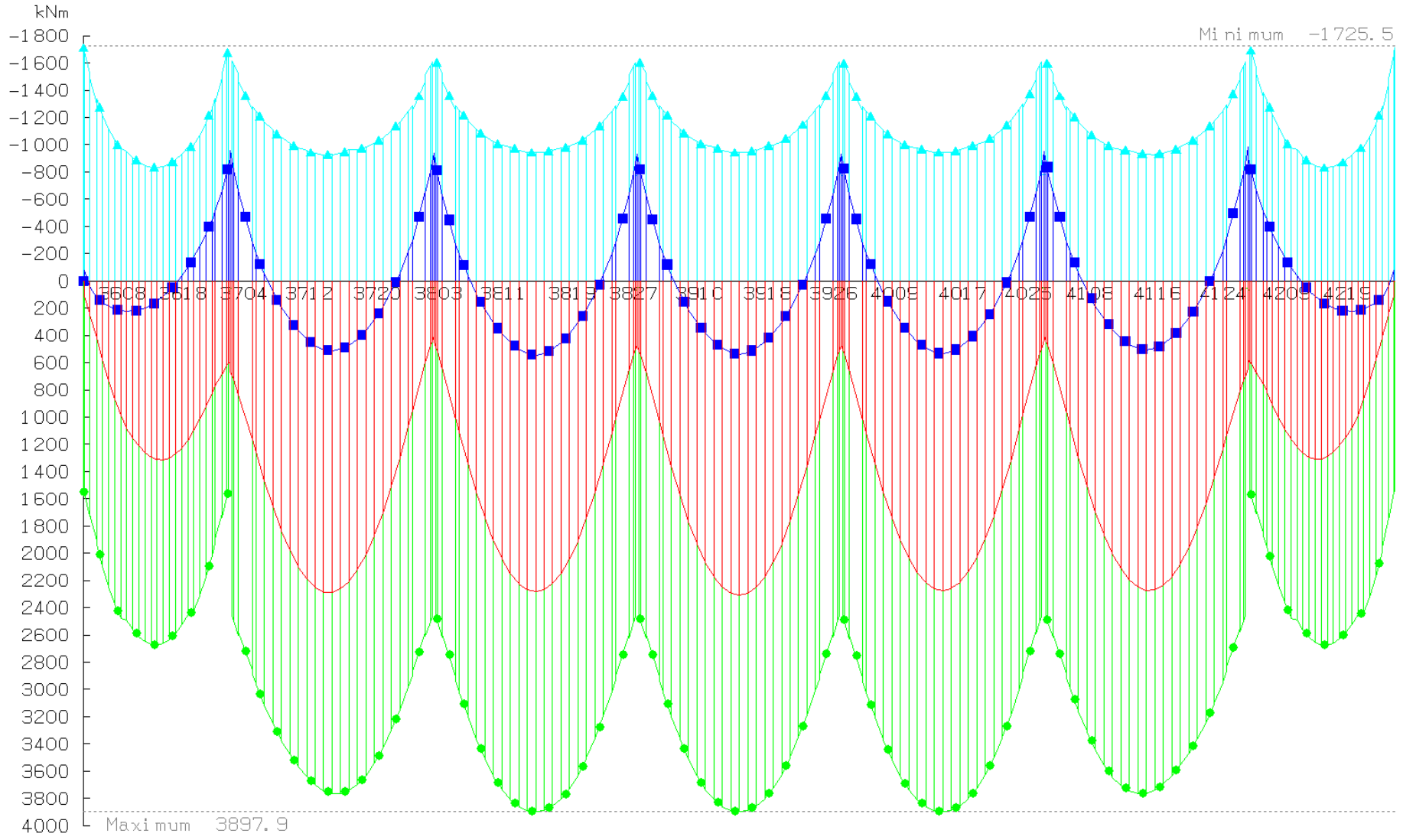
RmSet: BT-Ult-Comp, Stage: B11-Ult
Ultimate load carrying capacity

(DefaultSchedule)/BT-Ult-Comp

1 cm Plot = 445.4 kNm

0 445.4 890.9 1336.3 1781.8 2227.2

19/07/2021
10:51



ULS.sup
MaxMz: Mz
secondary: local: joined
(0 , 2308)

ULT-ULS.sup
MaxMz: Mz
secondary: local: joined
(46 , 3898)

ULS.sup
MinMz: Mz
secondary: local: joined
(-985 , 547)

ULT-ULS.sup
MinMz: Mz
secondary: local: joined
(-1725 , -772)

Author: DB Inzenjering , Beograd

Project: 95+739

Results for MaxMz: Mz, All Spans, Girder 6, Part 3, MOMENT, ULS.sup

RmSet: BU-Ult-Comp, Stage: B11-Ult
Ultimate load carrying capacity

(DefaultSchedule)/BU-Ult-Comp

1 cm Plot = 445.4 kNm

0 445.4 890.8 1336.3 1781.7 2227.1

19/07/2021
10:51

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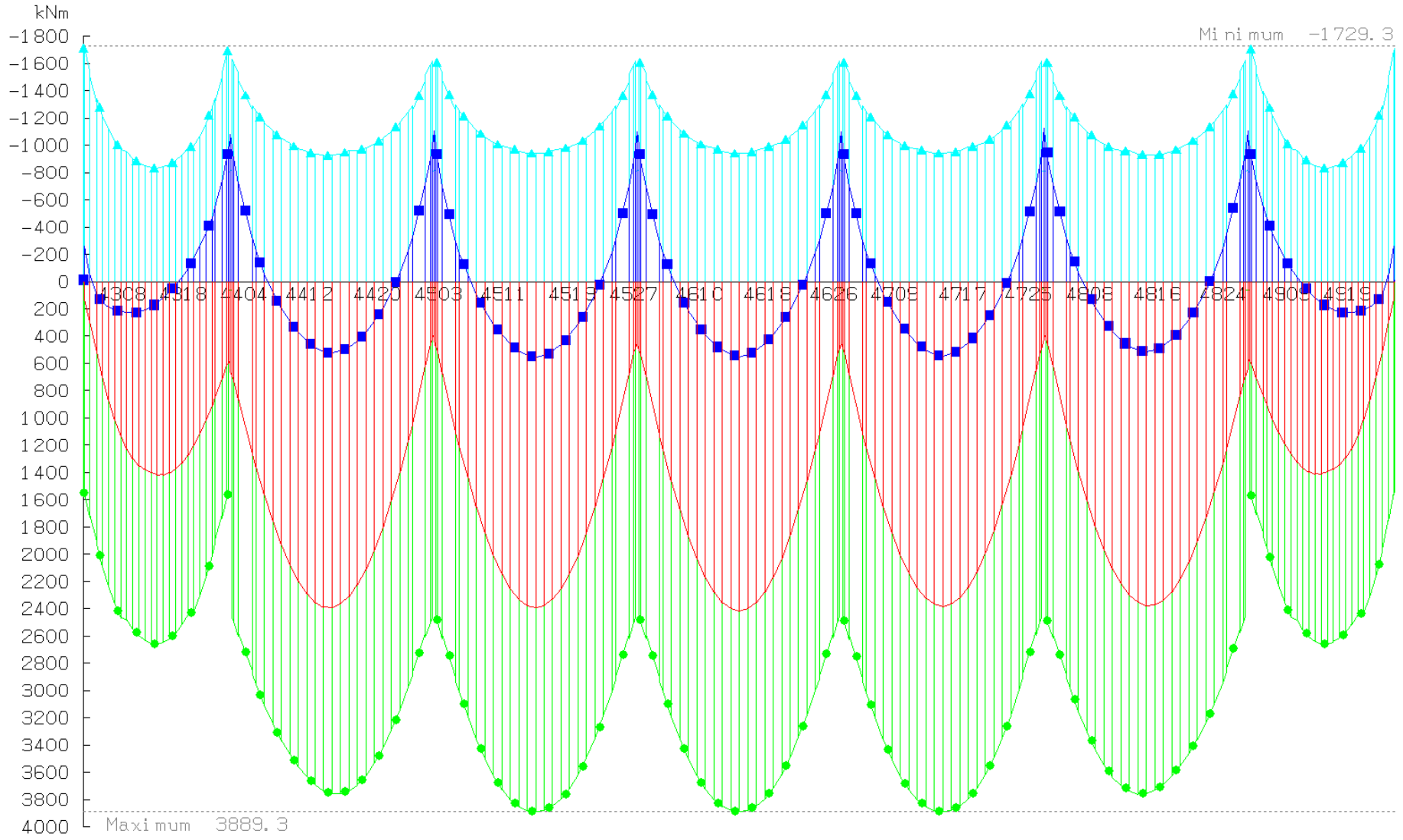
10.01.00.02



ULS.sup
MaxMz: Mz
secondary: local: joined
(0 , 2416)

ULT-ULS.sup
MaxMz: Mz
secondary: local: joined
(51 , 3889)

ULS.sup
MinMz: Mz
secondary: local: joined
(-1126 , 556)

ULT-ULS.sup
MinMz: Mz
secondary: local: joined
(-1729 , -802)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for MaxMz: Mz, All Spans, Girder 7, Part 3, MOMENT, ULS.sup

RmSet: BV-Ult-Comp, Stage: B11-Ult
Ultimate load carrying capacity

(DefaultSchedule)/BV-Ult-Comp

1 cm Plot = 445.0 kNm

0 445.0 890.1 1335.1 1780.1 2225.2

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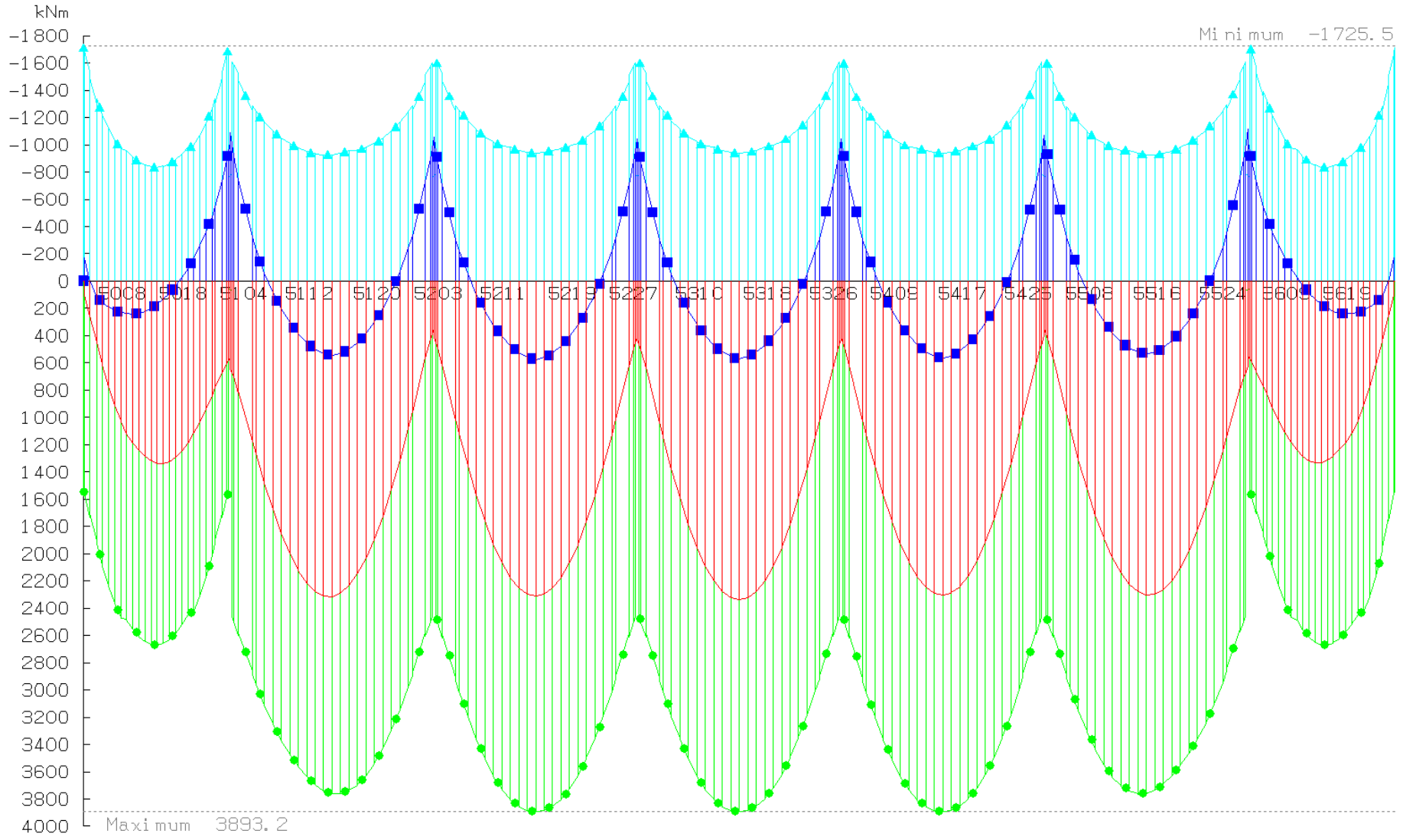
10:51



ULS.sup
MaxMz: Mz
secondary: local: joined
(0 , 2337)

ULT-ULS.sup
MaxMz: Mz
secondary: local: joined
(51 , 3893)

ULS.sup
MinMz: Mz
secondary: local: joined
(-1113 , 576)

ULT-ULS.sup
MinMz: Mz
secondary: local: joined
(-1725 , -762)

Author: DB Inzenjering , Beograd

Project: 95+739

Results for MaxMz: Mz, All Spans, Girder 8, Part 3, MOMENT, ULS.sup

RmSet: BW-Ult-Comp, Stage: B11-Ult
Ultimate load carrying capacity

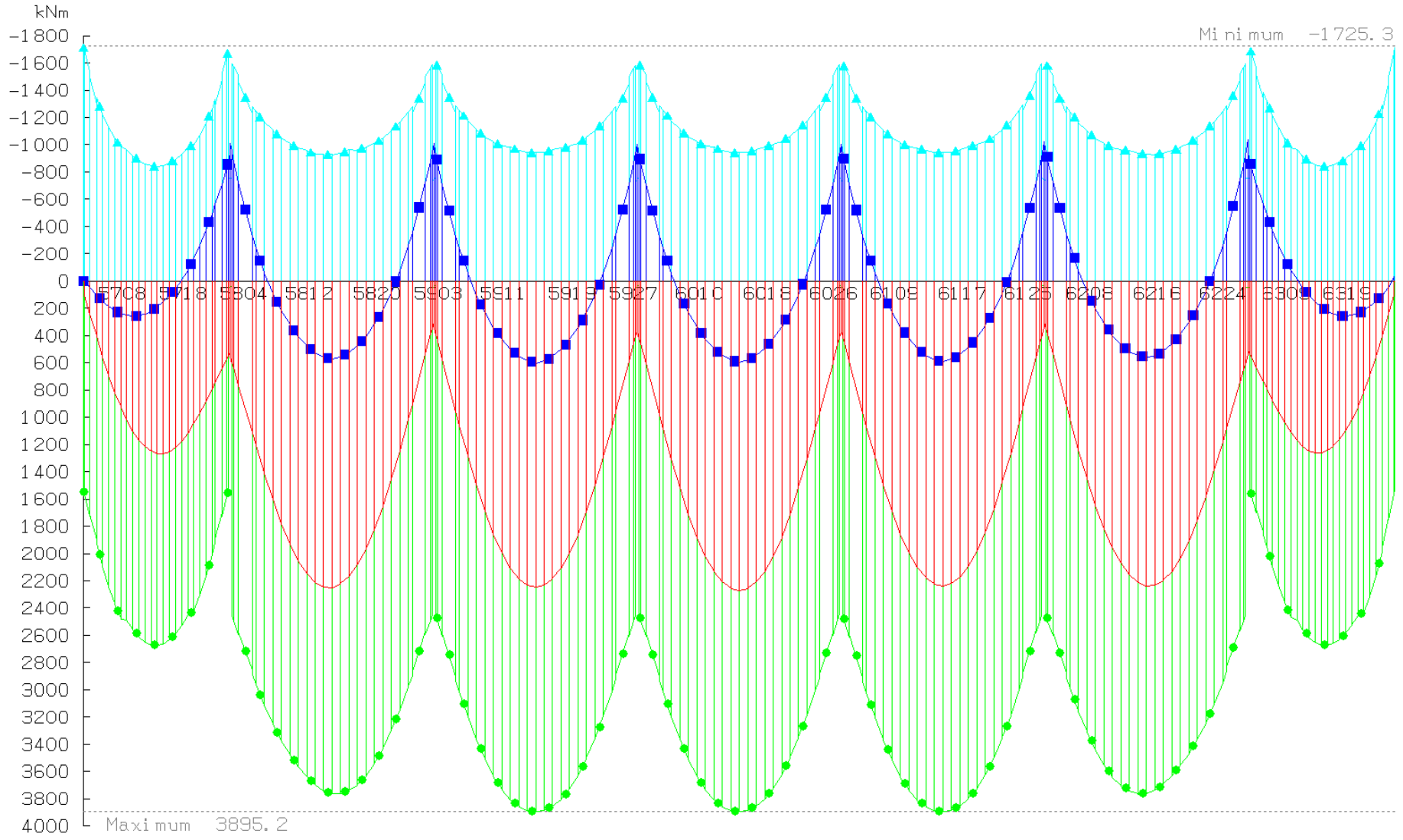
(DefaultSchedule)/BW-Ult-Comp

1 cm Plot = 445.0 kNm

0 445.0 890.1 1335.1 1780.2 2225.2

19/07/2021
10:51

RM Bridge Advanced CONNECT Edition
10.01.00.02



ULS.sup
MaxMz: Mz
secondary: local: joined
(0 , 2271)

ULT-ULS.sup
MaxMz: Mz
secondary: local: joined
(33 , 3895)

ULS.sup
MinMz: Mz
secondary: local: joined
(-1035 , 602)

ULT-ULS.sup
MinMz: Mz
secondary: local: joined
(-1725 , -731)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for MaxMz: Mz, All Spans, Girder 9, Part 3, MOMENT, ULS.sup

RmSet: BX-Ult-Comp, Stage: B11-Ult
Ultimate load carrying capacity

(DefaultSchedule)/BX-Ult-Comp

1 cm Plot = 445.2 kNm

0 445.2 890.4 1335.6 1780.8 2226.0

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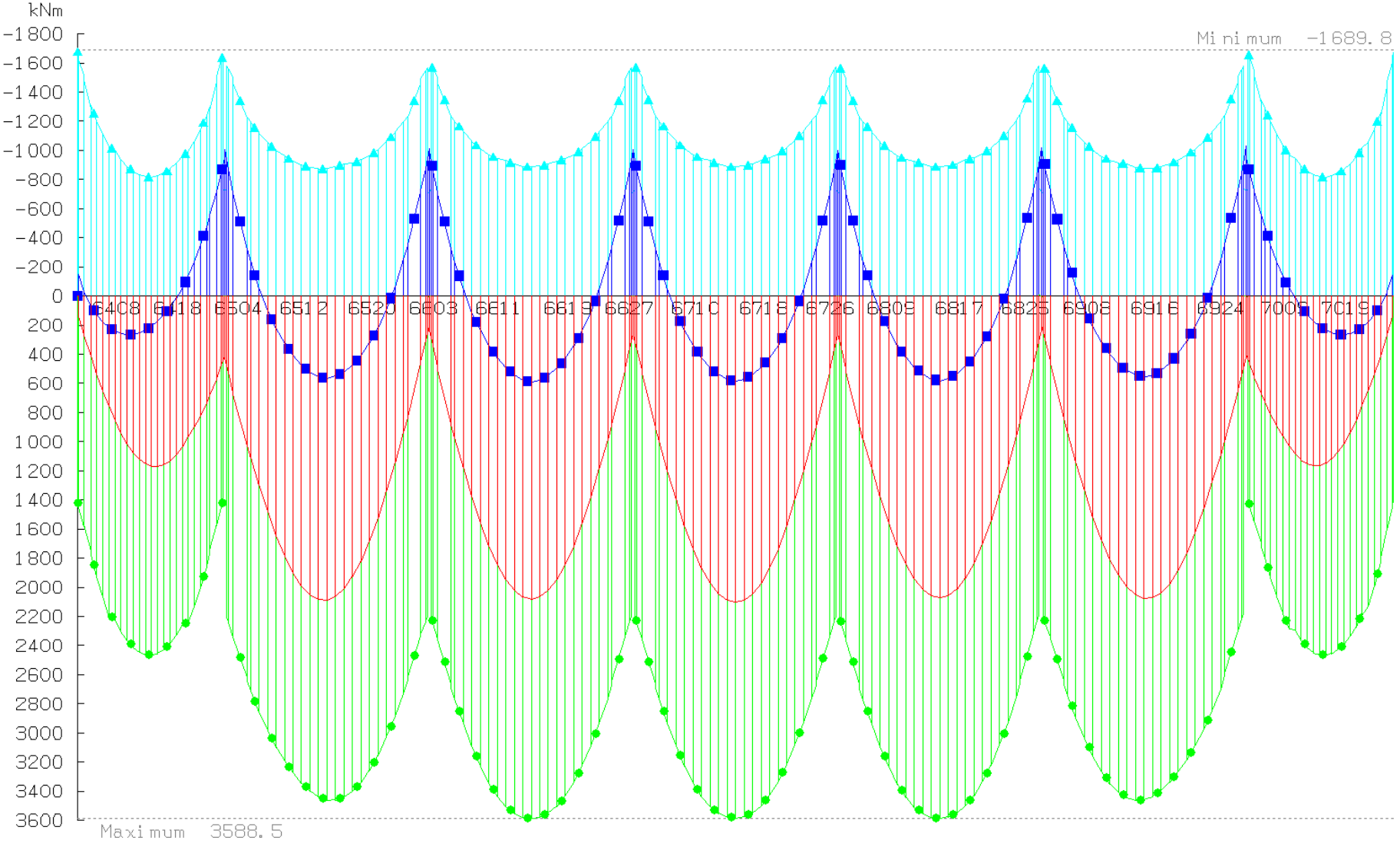
10:51



ULS.sup
MaxMz: Mz
secondary: local: joined
(0 , 2104)

ULT-ULS.sup
MaxMz: Mz
secondary: local: joined
(-7 , 3588)

ULS.sup
MinMz: Mz
secondary: local: joined
(-1029 , 592)

ULT-ULS.sup
MinMz: Mz
secondary: local: joined
(-1690 , -703)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

Results for MaxMz: Mz, All Spans, Girder 10, Part 3, MOMENT, ULS.sup

RmSet: BY-Ult-Comp, Stage: B11-Ult
Ultimate load carrying capacity

(DefaultSchedule)/BY-Ult-Comp

1 cm Plot = 418.1 kNm

0 418.1 836.2 1254.2 1672.3 2090.4

19/07/2021
10:51

4.4.4 АНАЛИЗА И ДИМЕНЗИОНИСАЊЕ ЛЕЖИШТА
BEARING ANALYSIS AND DESIGN

Контрола носивости / Load capacity check

Kombinacije opterećenja / Load combinations :

Comb1 → Доминантно возило / Dominant live load

$$\sum = 1.35(G+dG) + 1.0Sk + 1.35Ts + 1.35UDL + 1.35K + 0.9W$$

Comb2 → Доминантна температура / Dominant temperature load

$$\sum = 1.35(G+dG) + 1.0Sk + 1.01Ts + 0{,}54UDL + 0{,}54K + 1.5W + 1.5T$$

Comb3 → Доминантна сеизмика / Dominant seizmic load

$$\sum = 1.0(G+dG) + 1.0Sk + 1.0(20\%)UDL + 1.0Si + 0.3Sik$$

Opterećenje		Vertikalne reakcie / Vertical reactions				Horizontalne reakcie / Horizontal reactions			
Load case		S1l (kN)	S1d (kN)	S8l (kN)	S8d (kN)	S1l (kN)	S1d (kN)	S8l (kN)	S8d (kN)
Sopstvena zežina	max	-501	-505	-501	-505				
Self weight	min	-501	-505	-501	-505				
Dodatno stalno opt.	max	-116	-118	-116	-118				
SDL	min	-116	-118	-116	-118				
Skupljanje	max	-61	-61	-61	-61				
Creep	min	-61	-61	-61	-61				
LM1-TS	max	53	53	53	53				
	min	-538	-542	-538	-542				
LM1-UDL	max	28	28	28	28				
	min	-181	-182	-181	-182				
Pešaci	max	10	10	10	10				
Pedestrian	min	-24	-24	-24	-24				
Kočenje	max	17	17	17	17				
Brake	min	-17	-17	-17	-17				
Temperatura	max	65	66	65	66				
Temp.	min	-98	-99	-98	-99				
Vetar	max	22	22	22	22	25	25	25	25
Wind	min	-22	-22	-22	-22	-25	-25	-25	-25
Seizmika	max	258	254	258	254	215	224	215	224
Earthquake	min	-258	-254	-258	-254	-215	-224	-215	-224

Comb1	ULS(max)	-548	-554	-548	-554	25	25	25	25
	ULS(min)	-1940	**-1955**	-1940	-1955	-25	-25	-25	-25
Comb2	ULS(max)	-482	-487	**-482**	-487	38	38	38	38
	ULS(min)	-1737	-1751	-1737	-1751	-38	-38	-38	-38
Comb3	ULS(max)	-414	-424	-414	-424	215	224	215	224
	ULS(min)	-972	-974	-972	-974	-215	**-224**	-215	-224

Контрола померања / Displacement capacity check

Kombinacije opterećenja / Load combinations :

Comb1 → Доминантна температура / Dominant temperature load

$$\sum = 1.0Sk + 1.0K + 1.5T$$

Comb2 → Доминантна сеизмика / Dominant seizmic load

$$\sum = 1.0Sk + 1.5Sx + 0.5T$$

Opterećenje Load case	Horizontalno pom. Horizontal disp. S1 (mm)	 S8 (mm)
Skupljanje Creep	22	-22
Kočenje Brake	9 -9	9 -9
Temperatura +54 Temp. +54	-40	40
Temperatura -51 Temp. -51	38	-38
Seizmika Earthquake	15 -15	15 -15

Comb1	88 -69	-88 69
Comb2	63 -42	-63 42

Nmax = 1955 kN → **максимано вертикално оптерећење /** maximal vertical load

Nmin = 482 kN → **минимално вертикално оптерећење /** minimal vertical load

Vx = 224 kN → **максимално хоризонтално оптерећење /** maximal horizontal load

U = ±88 mm → **максимално хоризонтално померање /** maximal horizontal movement

Усвојено лончасто лежиште / Require pot bearing

Подужно померљиво / longitudinal guided

Nd = 2772 kN > 1955 kN

Vx,d = 542 kN > 224 kN

Ud = ±90 mm > ± 88 mm

4.4.5 ДИЛАТАЦИЈЕ
EXPANSION JOINTS

N°	OPTEREĆENJE	S1	S8
	LOAD	u [mm]	u [mm]
1	TEMP. t = +54^0	-39.8	39.8
2	TEMP. t = -51^0	37.7	-37.7
3	SKUPLJANJE / CREEP	22.0	-22.0
A	Umin = 2 + 1.3x3	**66.3**	**-66.3**
	Umax = 1	**-39.8**	**39.8**
4	TEMP. t = +34^0	-25.0	25.0
5	TEMP. t = -31^0	23.0	-23.0
6	SEIZMIKA ±SX	15.0	15.0
		-15.0	-15.0
B	Umin =(qx6) + 0.5*(0.4*5) +3	**44.5**	**-44.5**
	Umax = (qx6) + 0.5*(0.4*4)	**-23.0**	**23.0**

q = 1.0

A Osnovno opterećenje
B Seizmika - nekritični elementi

Дилатација / Expansion joint

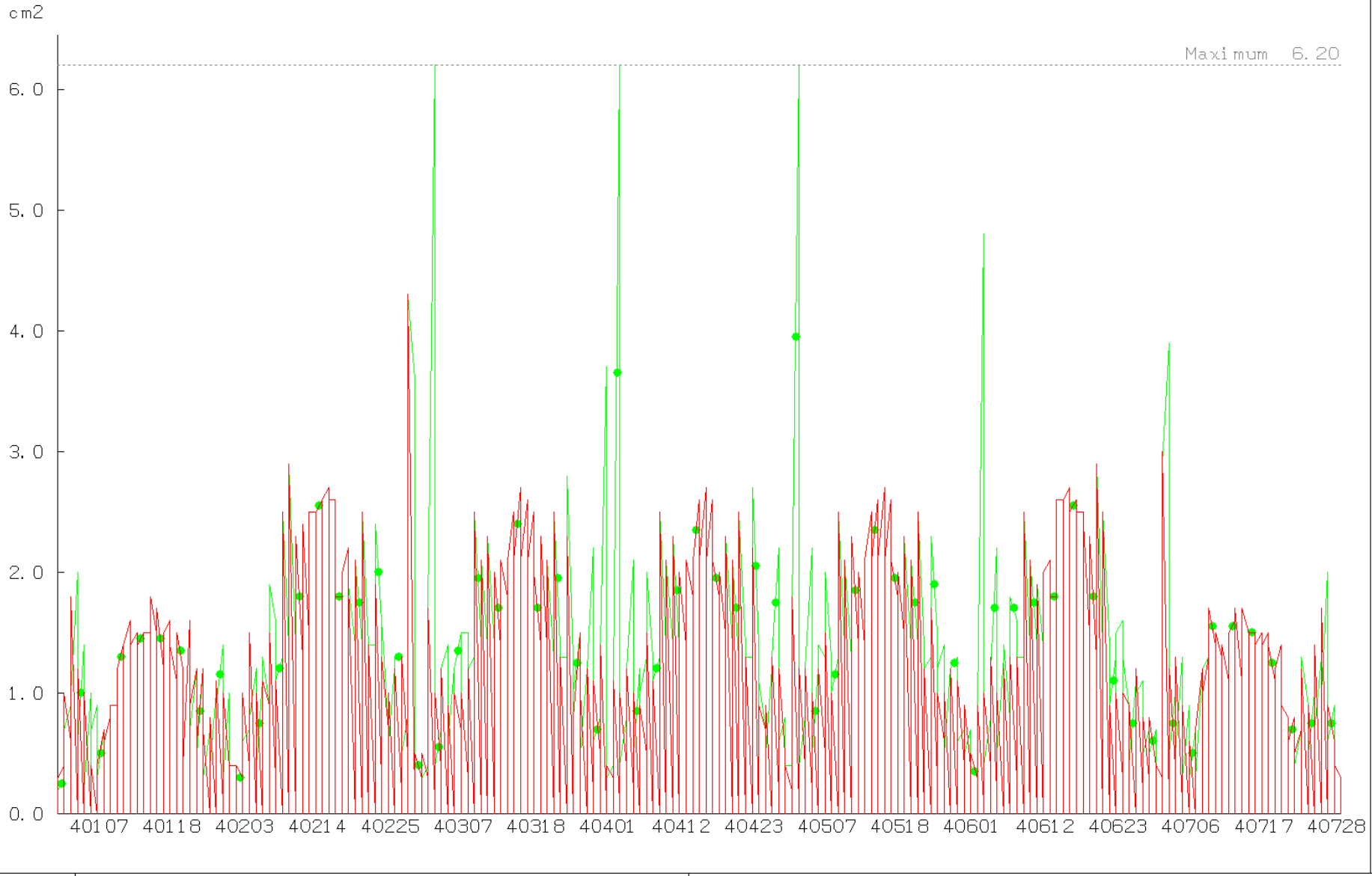
Усвојена дилатација / provided expansion joint

D±80 mm

4.5. АНАЛИЗА СУПЕРСТРУКТУРЕ – ПОПРЕЧНИ ПРАВАЦ

STRUCTURAL ANALYSIS – TRANSVERSE DIRECTION

4.5.1 ПРОРАЧУН НОСИВОСТИ КОЛОВОЗНЕ ПЛОЧЕ
DECK SLAB CAPACITY



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

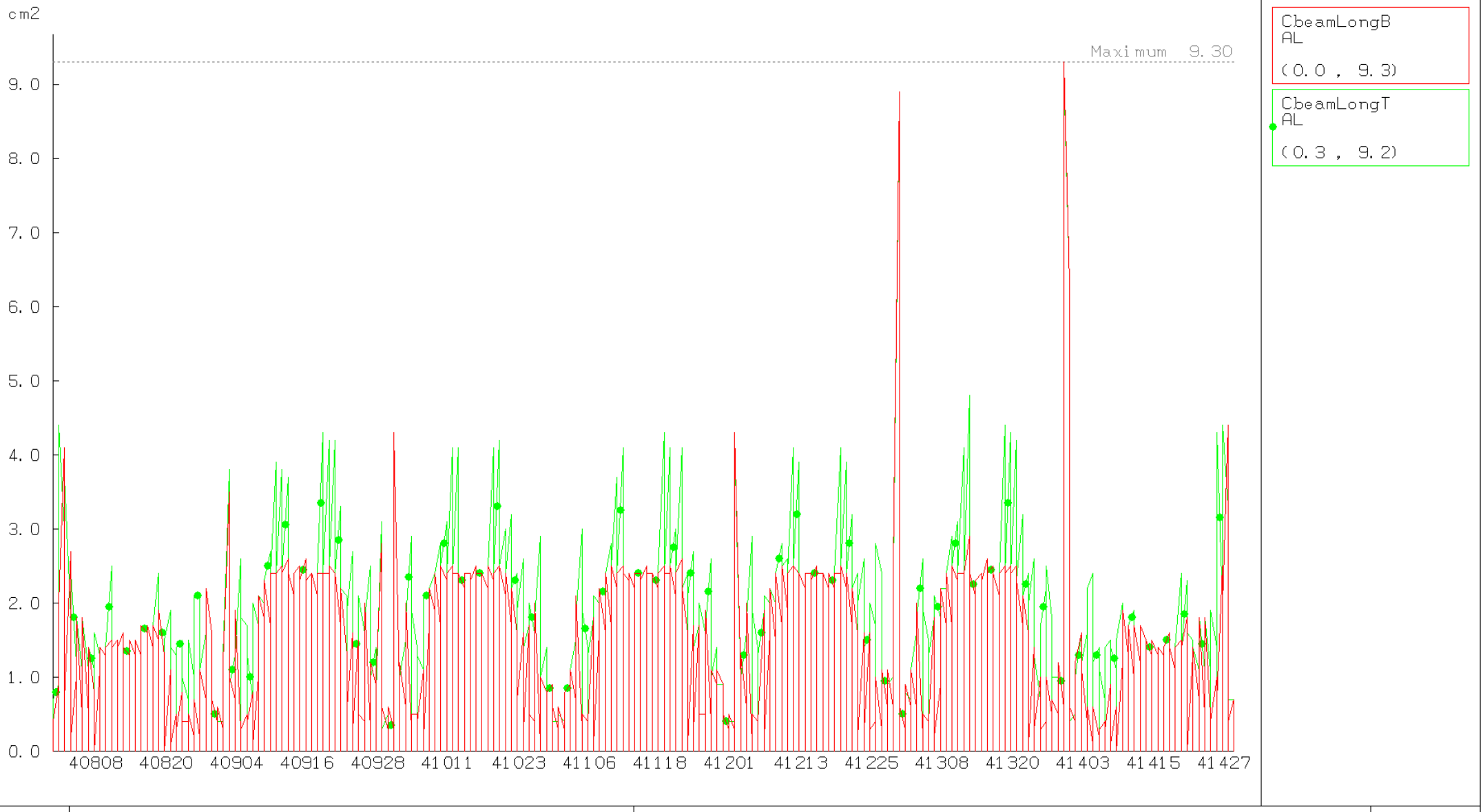
RmSet: Slab1-2, Stage: B12-SlabTrans

(DefaultSchedule)/B12-SlabTrans1

1 cm Plot = 0.491 cm2

0 0.491 0.982 1.473 1.964 2.455

19/07/2021
10:51



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

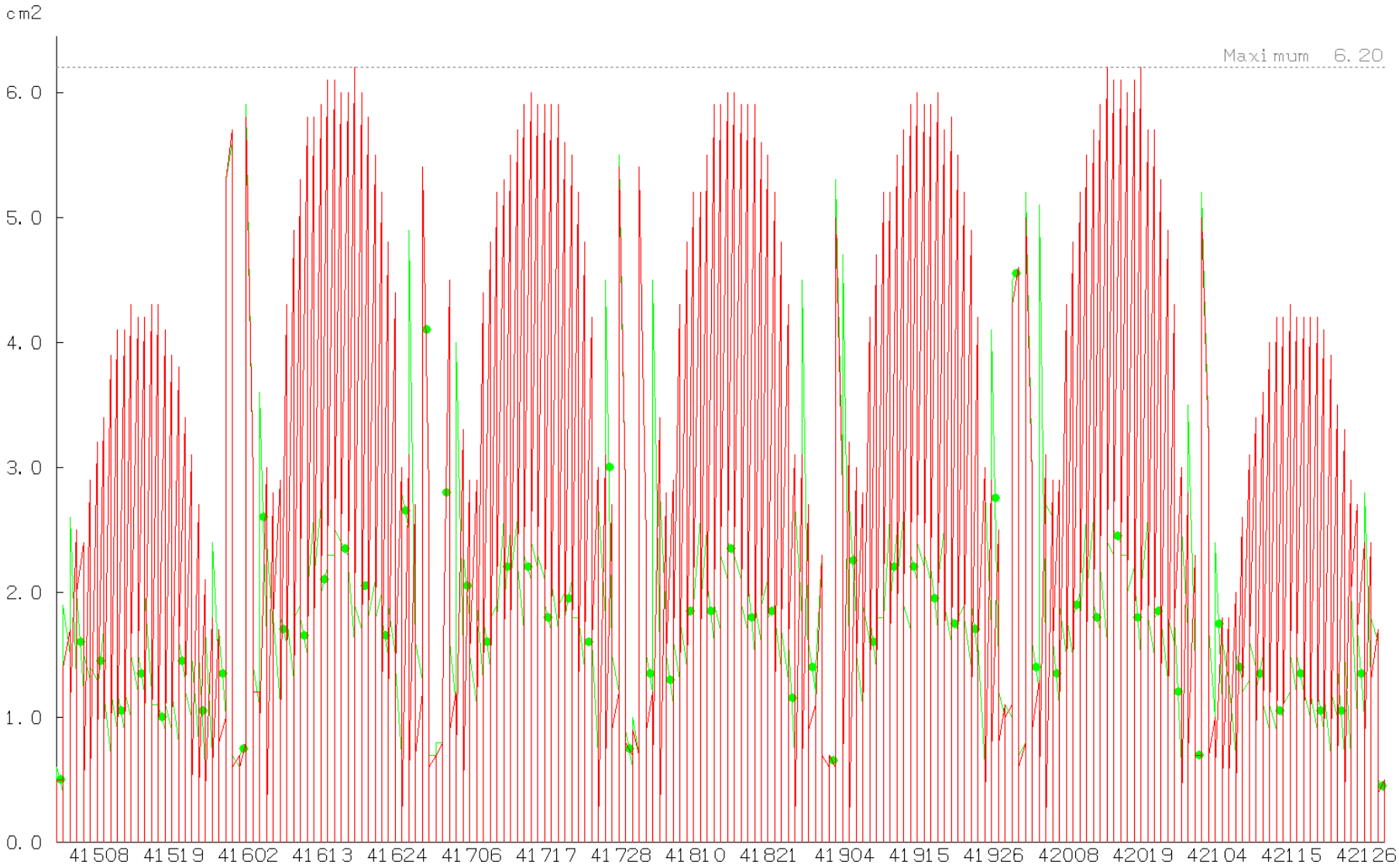
RmSet: Slab2-3, Stage: B12-SlabTrans

(DefaultSchedule)/B12-SlabTrans2

1 cm Plot = 0.737 cm2

0 0.737 1.473 2.210 2.947 3.683

19/07/2021
10:51



CbeamLongB
AL
(0.1 , 6.2)

CbeamLongT
AL
(0.4 , 5.9)

RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: Slab3-4, Stage: B12-SlabTrans

(DefaultSchedule)/B12-SlabTrans3

1 cm Plot = 0.491 cm2

0 0.491 0.982 1.473 1.964 2.455

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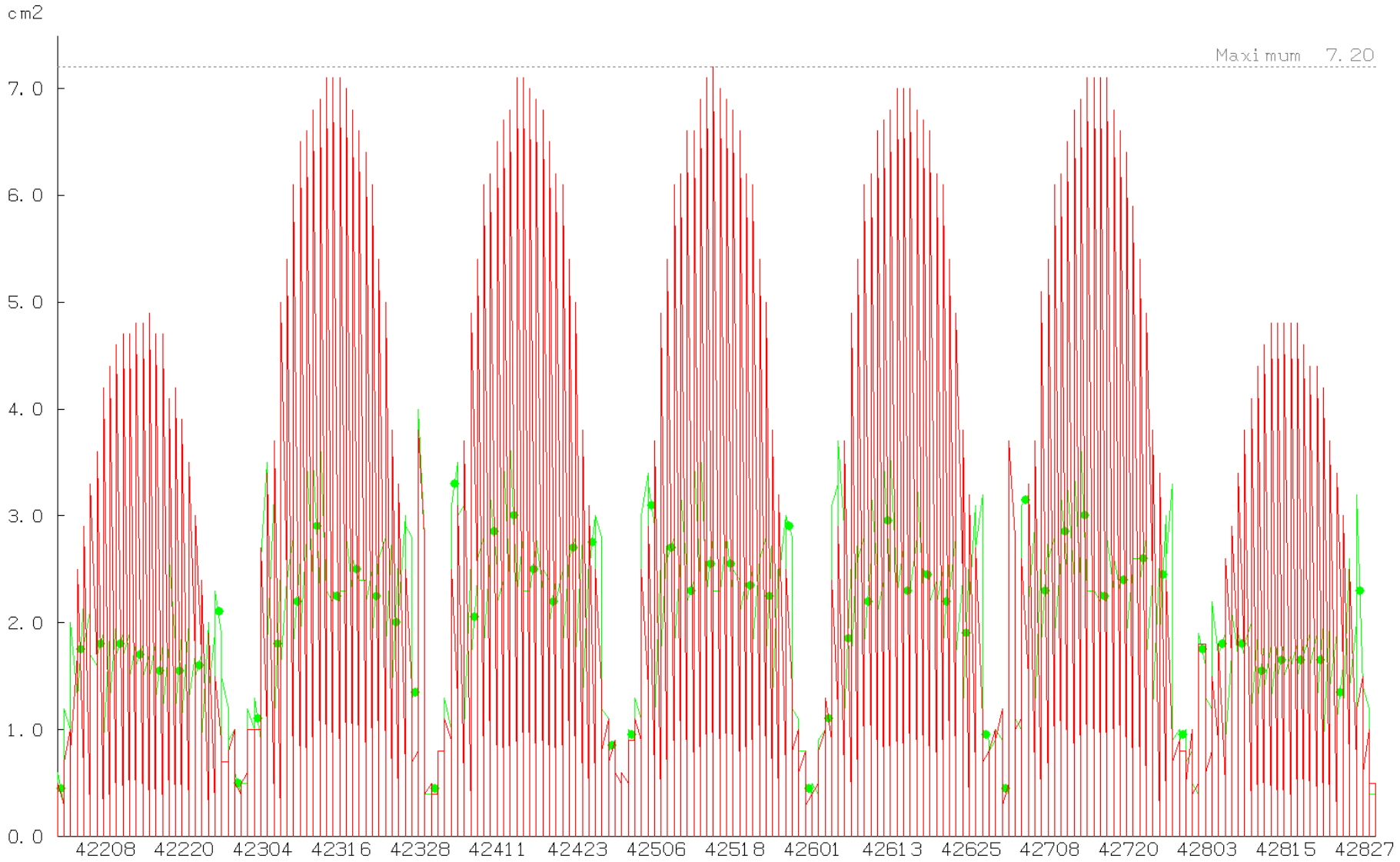
10:51



CbeamLongB
AL
(0.1 , 7.2)

CbeamLongT
AL
(0.3 , 4.0)

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: Slab4-5, Stage: B12-SlabTrans

(DefaultSchedule)/B12-SlabTrans4

1 cm Plot = 0.570 cm2

0 0.570 1.141 1.711 2.281 2.851

19/07/2021
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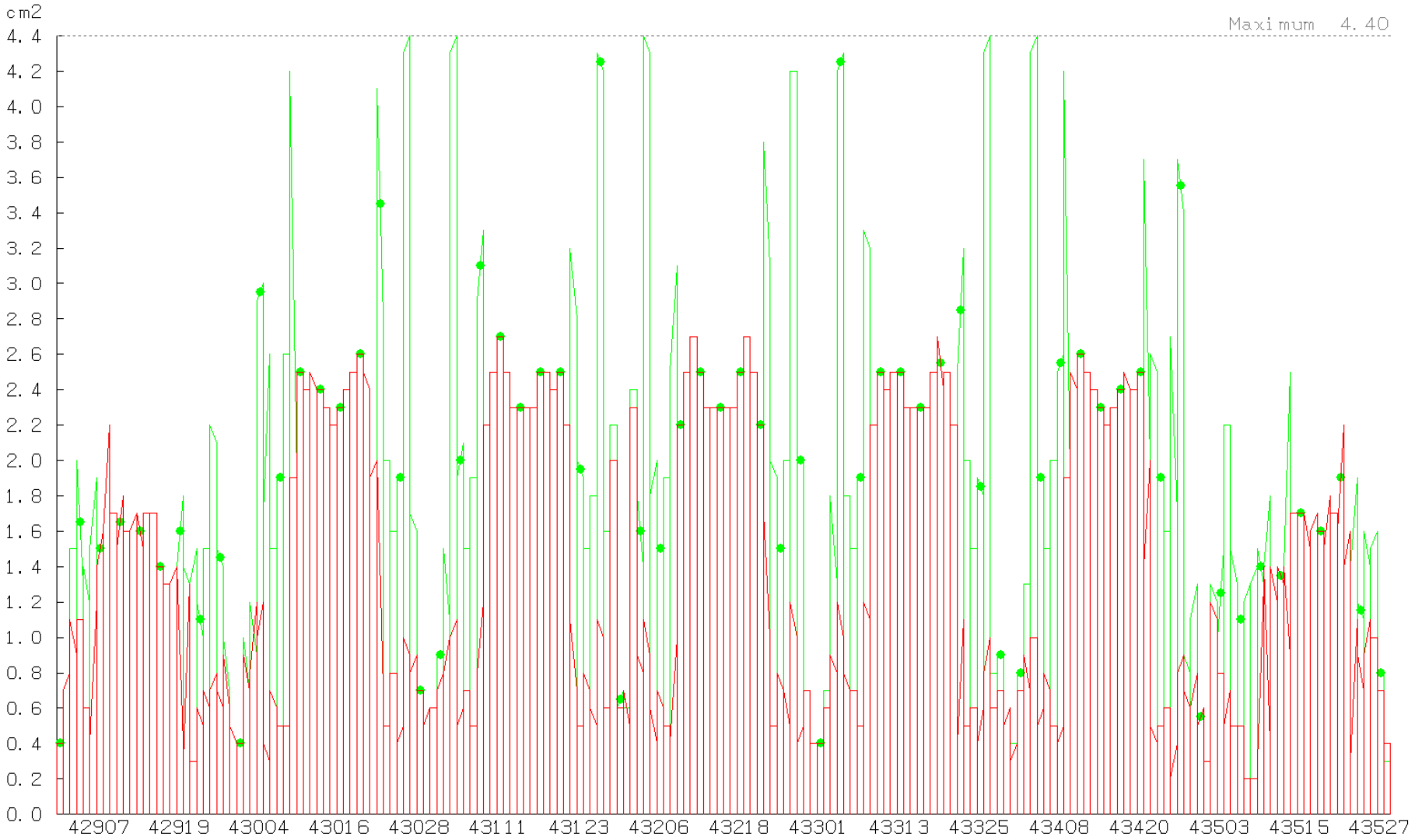
RM Bridge Advanced CONNECT Edition
10.01.00.02



CbeamLongB
AL
(0.2 , 2.7)

CbeamLongT
AL
(0.3 , 4.4)

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: Slab5-6, Stage: B12-SlabTrans

(DefaultSchedule)/B12-SlabTrans5

1 cm Plot = 0.349 cm2

0 0.349 0.697 1.046 1.394 1.743

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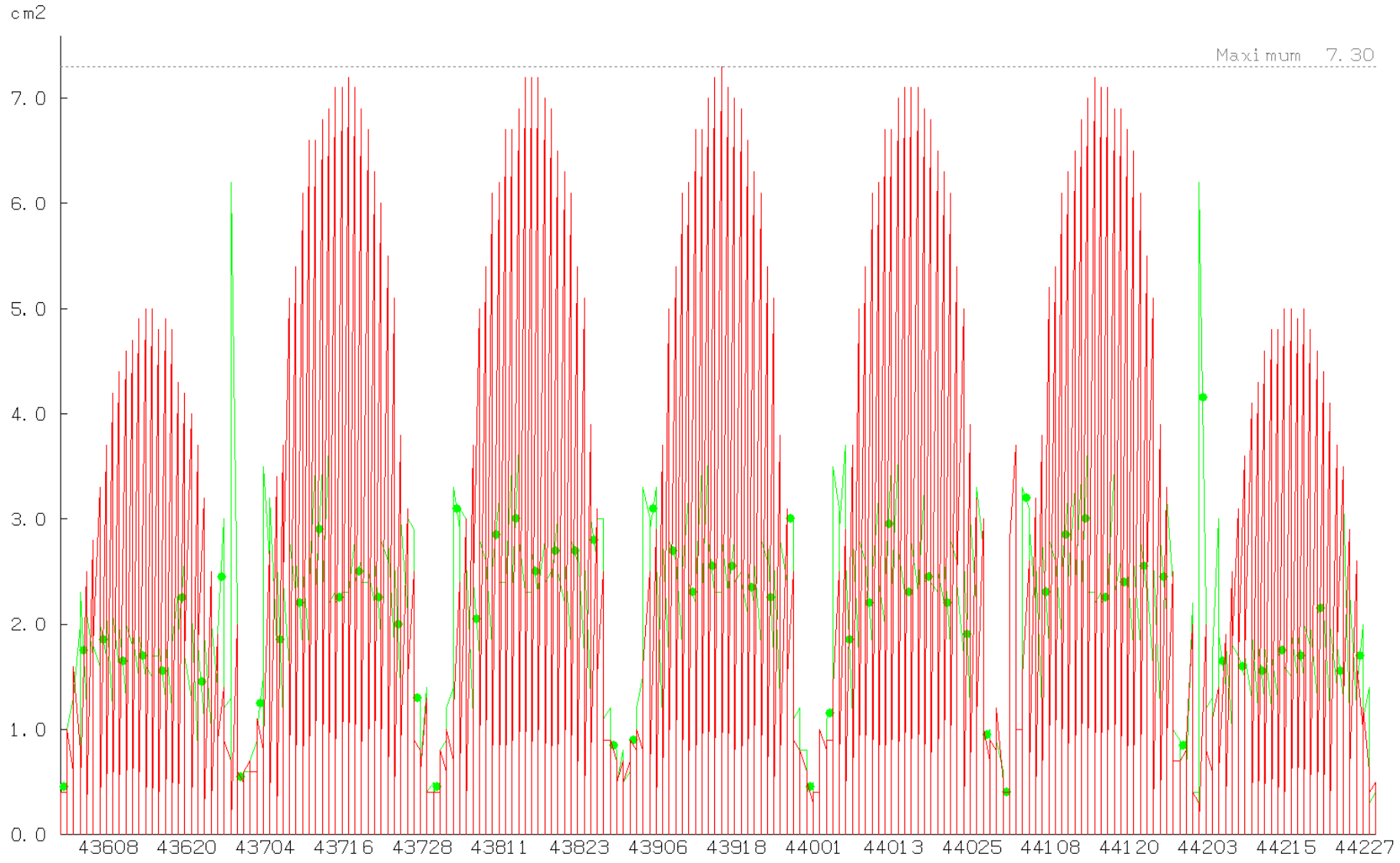
10:51

RM Bridge Advanced CONNECT Edition
10.01.00.02



CbeamLongB
AL
(0.1 , 7.3)

CbeamLongT
AL
(0.3 , 6.2)

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: Slab6-7, Stage: B12-SlabTrans

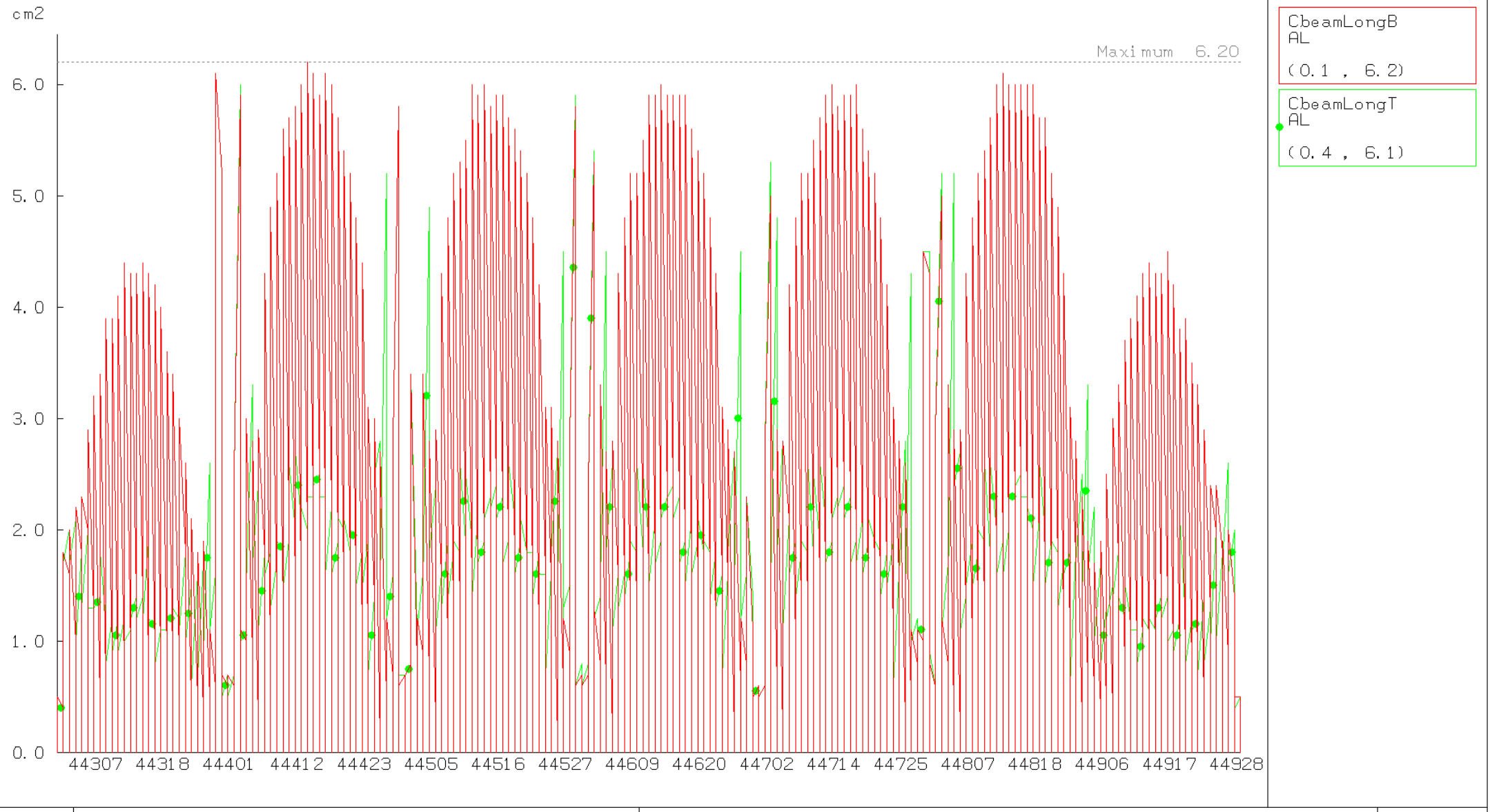
(DefaultSchedule)/B12-SlabTrans6

1 cm Plot = 0.578 cm2

0 0.578 1.156 1.735 2.313 2.891

19/07/2021
10:51

RM Bridge Advanced CONNECT Edition
10.01.00.02



Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: Slab7-8, Stage: B12-SlabTrans

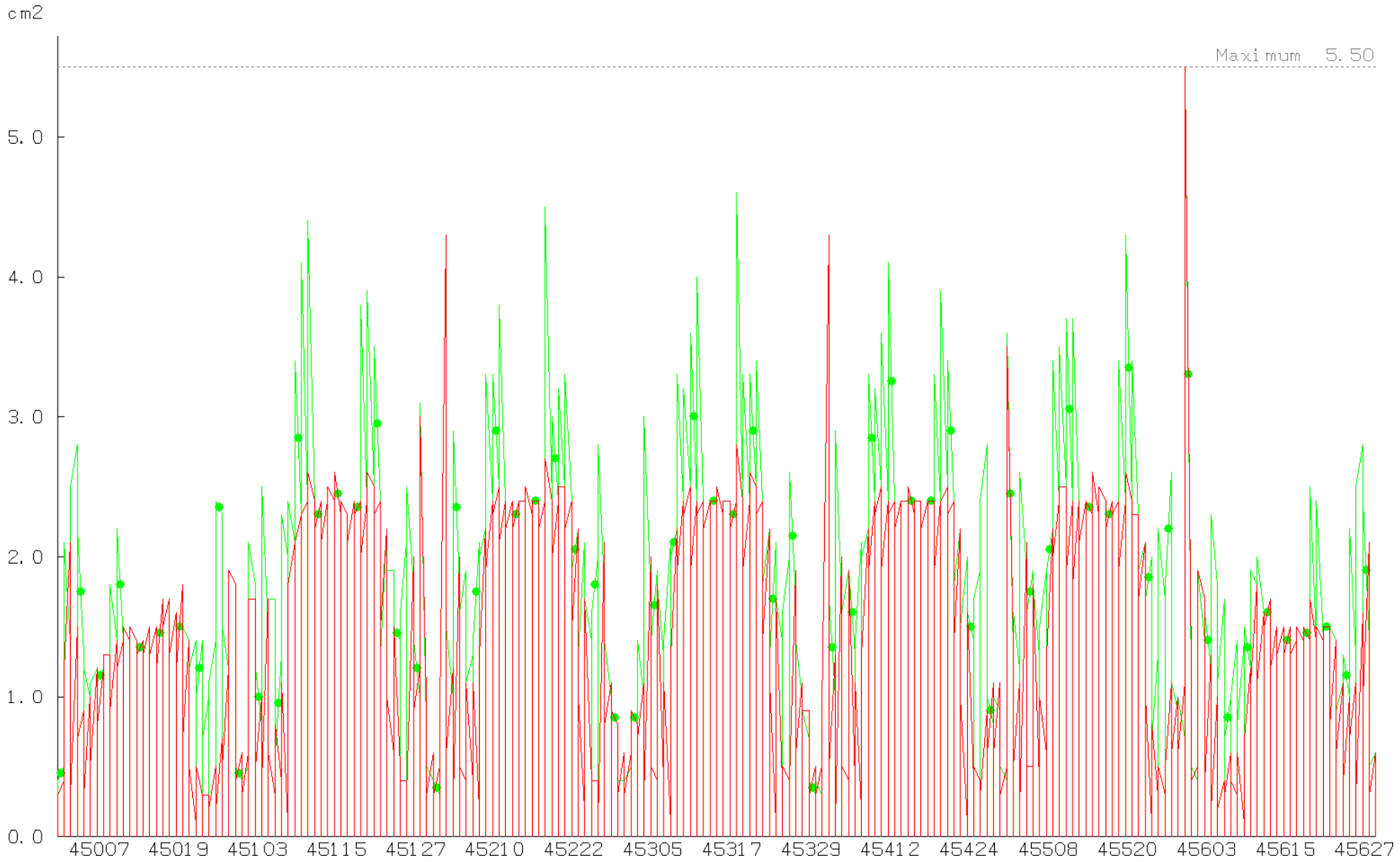
(DefaultSchedule)/B12-SlabTrans7

1 cm Plot = 0.491 cm2

0 0.491 0.982 1.473 1.964 2.455

19/07/2021
10:51

RM Bridge Advanced CONNECT Edition
10.01.00.02



Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: Slab8-9, Stage: B12-SlabTrans

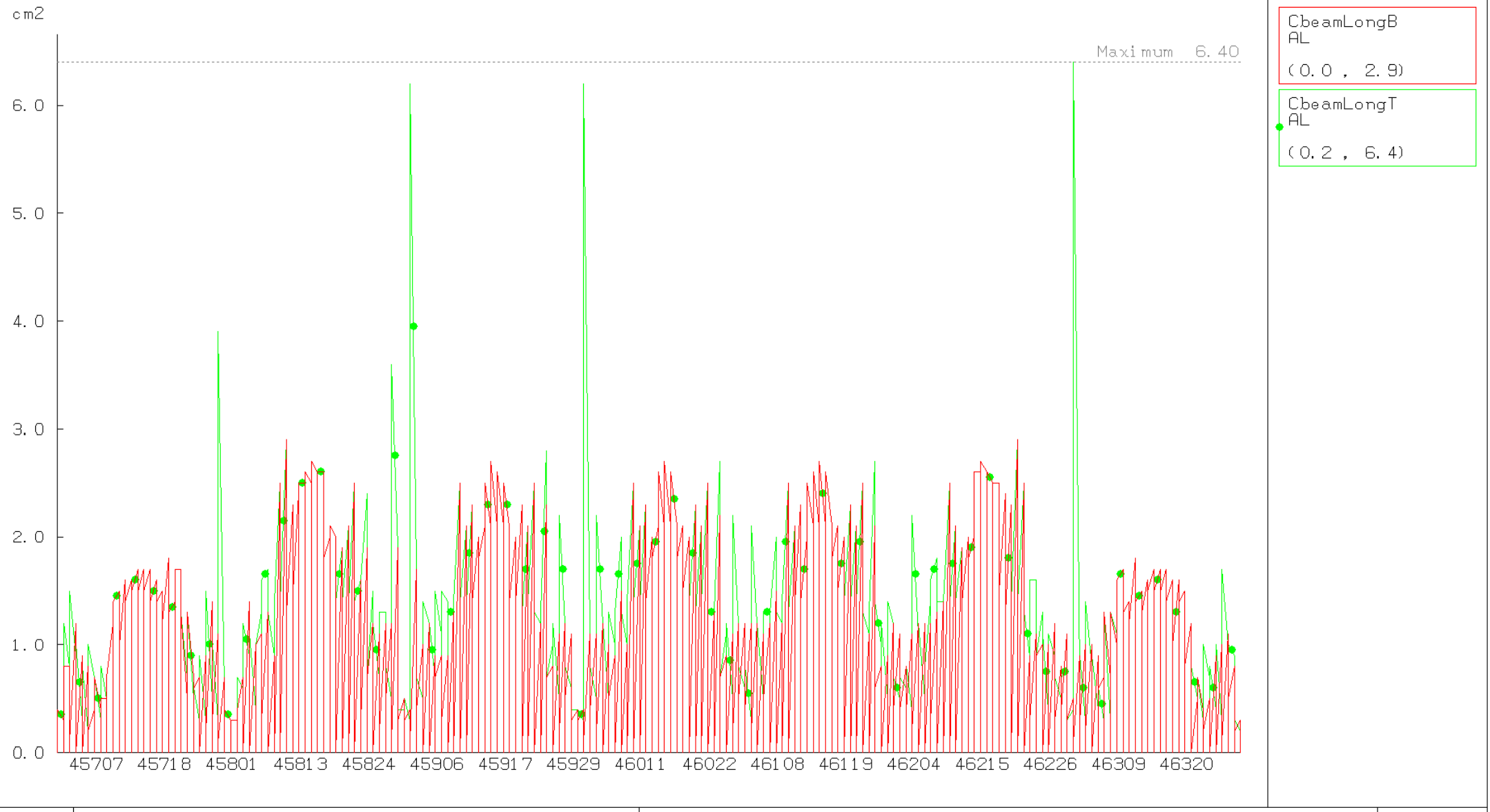
(DefaultSchedule)/B12-SlabTrans8

1 cm Plot = 0.436 cm2

0 0.436 0.871 1.307 1.743 2.178

19/07/2021
10:51

RM Bridge Advanced CONNECT Edition
10.01.00.02



RM Bridge Advanced CONNECT Edition
10.01.00.02

Author: DB Inzenjering , Beograd

Project: 95+739

RmSet: Slab9-10, Stage: B12-SlabTrans

(DefaultSchedule)/B12-SlabTrans9

1 cm Plot = 0.507 cm2

0 0.507 1.014 1.521 2.028 2.535

19/07/2021
10:51

Потребна арматура / required reinforcement

Aa = 9.60 cm2

L = 0.9667 m → **дужина елемента** / element lenght

Aa = 9.60/0.9667 = 9.93 cm2/m

Усвојена арматура / provided reinforcement :

Ф16/15 → Aa = 13.40 cm2/m

4.5.2 ПРОРАЧУН НОСИВОСТИ ПОПРЕЧНИХ НОСАЧА
CAPACITY OF DIAPHRAGMS

Размарана су следећа оптерећења / The following loads were considered :

- **G – Сопствена тежина /** Self weight
- **dG – Додатно стално оптерећење /** Superimposed load
- **Sk – Скупљање /** Creep
- **TS - Двоосовински тандем систем концентрисаних сила /** Tandem system
- **UDL - једнакоподељено површинско оптерећење /** uniformly distributed load
- **K – Силе кочења /** Braking forces
- **T – Температурна промена** / Uniform temperature change
- **dT – Температурна разлика** / Linear temperature change
- **W – Ветар** / wind
- **Sx,y,z – Сеизмика /** Seizmic load

Kombinacije opterećenja / Load combinations :

Comb1 → Доминантно возило / Dominant live load

$$\sum = 1.35(G+dG) + 1.0Sk + 1.35Ts + 1.35UDL + 1.35K + 0.9W$$

Comb2 → Доминантна температура / Dominant temperature load

$$\sum = 1.35(G+dG) + 1.0Sk + 1.01Ts + 0{,}54UDL + 0{,}54K + 1.5W + 1.5T$$

Comb3 → Доминантна сеизмика / Dominant seizmic load

$$\sum = 1.0(G+dG) + 1.0Sk + 1.0(20\%)UDL + 1.0Si + 0.3Sik$$

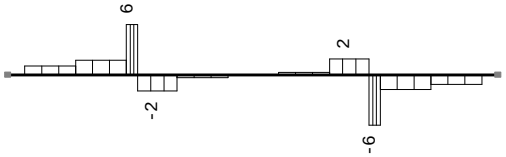
Opt. 1: Sopostvena tezina (g)

Ram: V_5
Uticaji u gredi: max M3= 2038 / min M3= -538 kNm

Opt. 1: Sopostvena tezina (g)

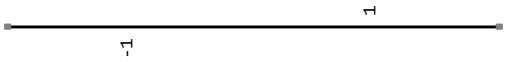
Ram: V_5
Uticaji u gredi: max M2= 291 / min M2= -291 kNm

Opt. 1: Sopostvena tezina (g)



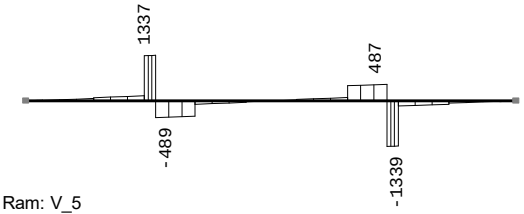
Ram: V_5
Uticaji u gredi: max M1= 6 / min M1= -6 kNm

Opt. 1: Sopostvena tezina (g)



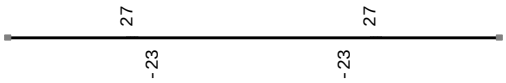
Ram: V_5
Uticaji u gredi: max T3= 50 / min T3= -50 kN

Opt. 1: Sopostvena tezina (g)



Ram: V_5
Uticaji u gredi: max T2= 1480 / min T2= -1480 kN

Opt. 1: Sopostvena tezina (g)



Ram: V_5
Uticaji u gredi: max N1= 34 / min N1= -2060 kN

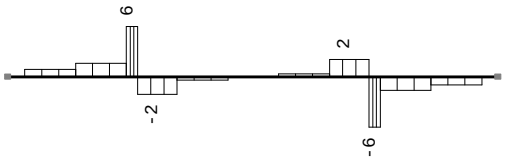
Opt. 2: Dodatno stalno

Ram: V_5
Uticaji u gredi: max M3= 474 / min M3= -145 kNm

Opt. 2: Dodatno stalno

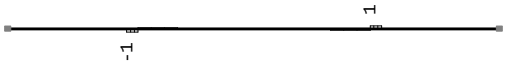
Ram: V_5
Uticaji u gredi: max M2= 64 / min M2= -64 kNm

Opt. 2: Dodatno stalno



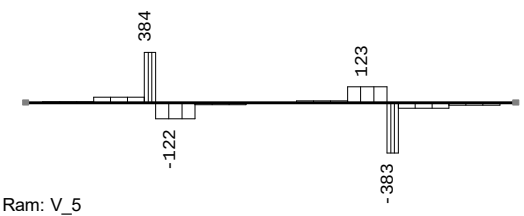
Ram: V_5
Uticaji u gredi: max M1= 6 / min M1= -6 kNm

Opt. 2: Dodatno stalno



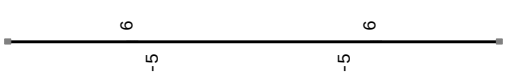
Ram: V_5
Uticaji u gredi: max T3= 10 / min T3= -10 kN

Opt. 2: Dodatno stalno



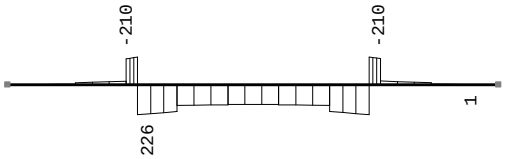
Ram: V_5
Uticaji u gredi: max T2= 384 / min T2= -383 kN

Opt. 2: Dodatno stalno



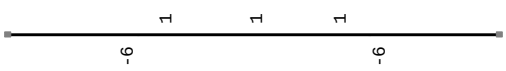
Ram: V_5
Uticaji u gredi: max N1= 7 / min N1= -506 kN

Opt. 4: Skupljanje



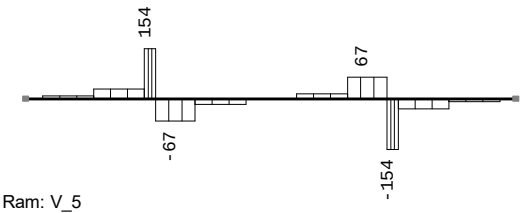
Ram: V_5
Uticaji u gredi: max M3= 383 / min M3= -221 kNm

Opt. 4: Skupljanje



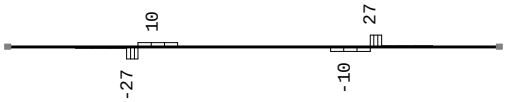
Ram: V_5
Uticaji u gredi: max M2= 436 / min M2= -436 kNm

Opt. 4: Skupljanje



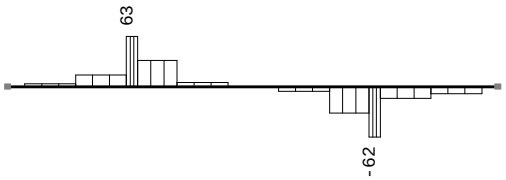
Ram: V_5
Uticaji u gredi: max M1= 154 / min M1= -154 kNm

Opt. 4: Skupljanje



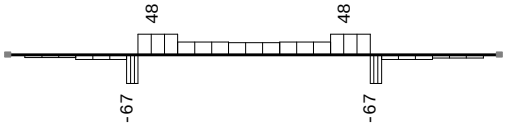
Ram: V_5
Uticaji u gredi: max T3= 115 / min T3= -115 kN

Opt. 4: Skupljanje



Ram: V_5
Uticaji u gredi: max T2= 63 / min T2= -62 kN

Opt. 4: Skupljanje

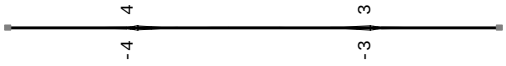


Ram: V_5
Uticaji u gredi: max N1= 48 / min N1= -118 kN

Opt. 5: TS

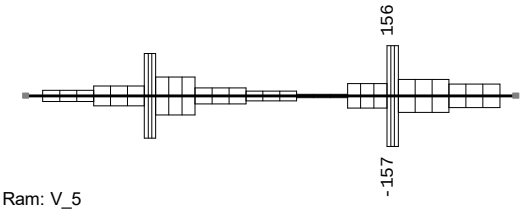
Ram: V_5
Uticaji u gredi: max M3= 501 / min M3= -195 kNm

Opt. 5: TS



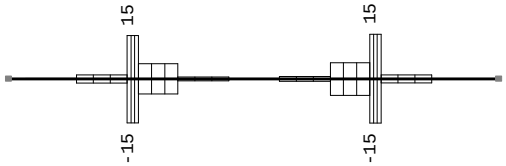
Ram: V_5
Uticaji u gredi: max M2= 68 / min M2= -74 kNm

Opt. 5: TS



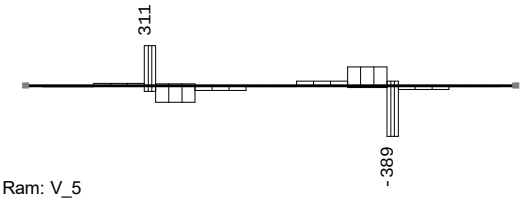
Ram: V_5
Uticaji u gredi: max M1= 156 / min M1= -157 kNm

Opt. 5: TS



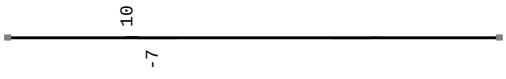
Ram: V_5
Uticaji u gredi: max T3= 15 / min T3= -17 kN

Opt. 5: TS



Ram: V_5
Uticaji u gredi: max T2= 334 / min T2= -389 kN

Opt. 5: TS

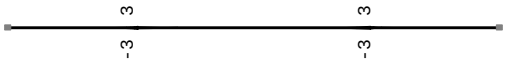


Ram: V_5
Uticaji u gredi: max N1= 58 / min N1= -535 kN

Opt. 6: UDL

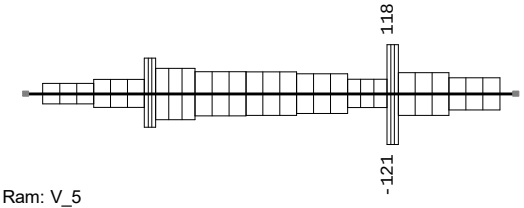
Ram: V_5
Uticaji u gredi: max M3= 592 / min M3= -142 kNm

Opt. 6: UDL



Ram: V_5
Uticaji u gredi: max M2= 95 / min M2= -76 kNm

Opt. 6: UDL

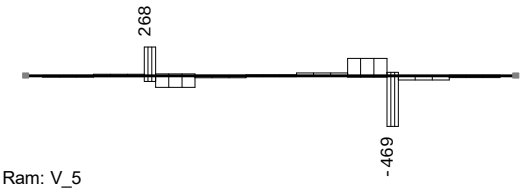


Ram: V_5
Uticaji u gredi: max M1= 118 / min M1= -121 kNm

Opt. 6: UDL

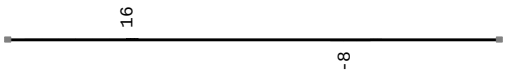
Ram: V_5
Uticaji u gredi: max T3= 11 / min T3= -22 kN

Opt. 6: UDL



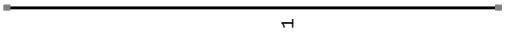
Ram: V_5
Uticaji u gredi: max T2= 382 / min T2= -469 kN

Opt. 6: UDL



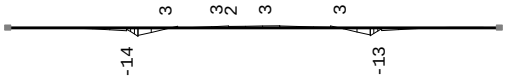
Ram: V_5
Uticaji u gredi: max N1= 69 / min N1= -631 kN

Opt. 7: Kocenje



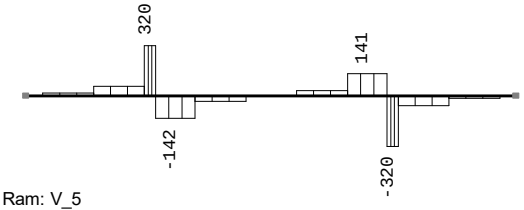
Ram: V_5
Uticaji u gredi: max M3= 154 / min M3= -461 kNm

Opt. 7: Kocenje



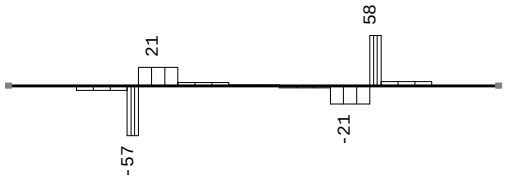
Ram: V_5
Uticaji u gredi: max M2= 81 / min M2= -14 kNm

Opt. 7: Kocenje



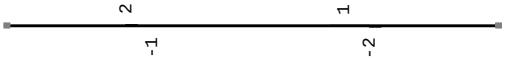
Ram: V_5
Uticaji u gredi: max M1= 320 / min M1= -320 kNm

Opt. 7: Kocenje



Ram: V_5
Uticaji u gredi: max T3= 58 / min T3= -57 kN

Opt. 7: Kocenje

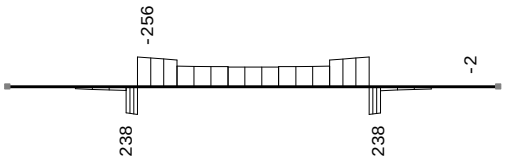


Ram: V_5
Uticaji u gredi: max T2= 27 / min T2= -78 kN

Opt. 7: Kocenje

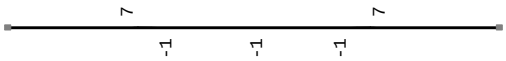
Ram: V_5
Uticaji u gredi: max N1= 0 / min N1= -3 kN

Opt. 8: T+34



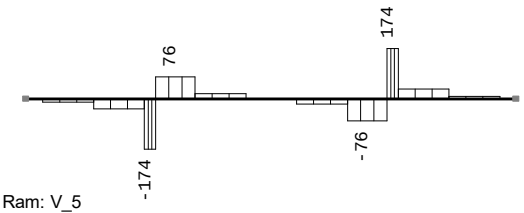
Ram: V_5
Uticaji u gredi: max M3= 250 / min M3= -434 kNm

Opt. 8: T+34



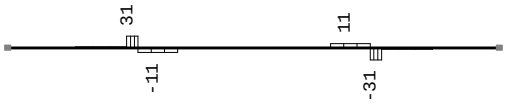
Ram: V_5
Uticaji u gredi: max M2= 494 / min M2= -494 kNm

Opt. 8: T+34



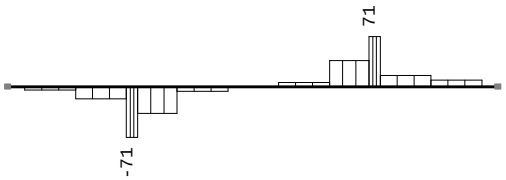
Ram: V_5
Uticaji u gredi: max M1= 174 / min M1= -174 kNm

Opt. 8: T+34



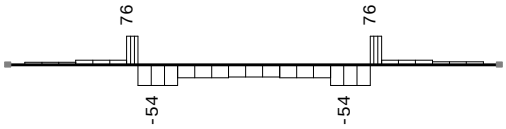
Ram: V_5
Uticaji u gredi: max T3= 130 / min T3= -130 kN

Opt. 8: T+34



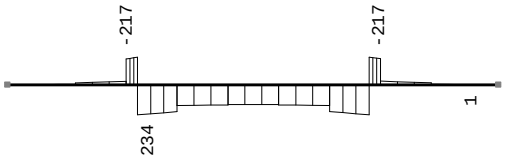
Ram: V_5
Uticaji u gredi: max T2= 71 / min T2= -71 kN

Opt. 8: T+34



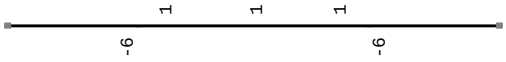
Ram: V_5
Uticaji u gredi: max N1= 134 / min N1= -54 kN

Opt. 9: T-31



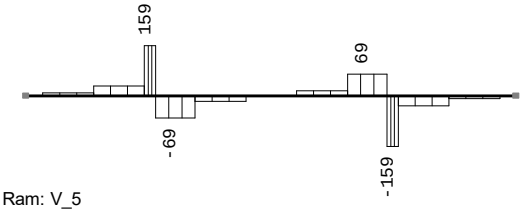
Ram: V_5
Uticaji u gredi: max M3= 396 / min M3= -228 kNm

Opt. 9: T-31



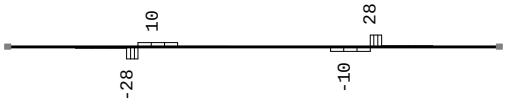
Ram: V_5
Uticaji u gredi: max M2= 451 / min M2= -451 kNm

Opt. 9: T-31



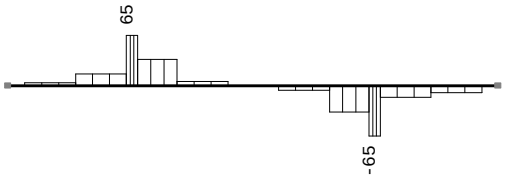
Ram: V_5
Uticaji u gredi: max M1= 159 / min M1= -159 kNm

Opt. 9: T-31



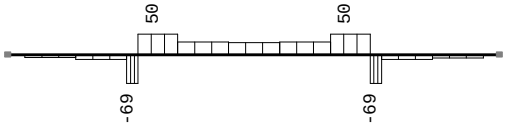
Ram: V_5
Uticaji u gredi: max T3= 119 / min T3= -119 kN

Opt. 9: T-31



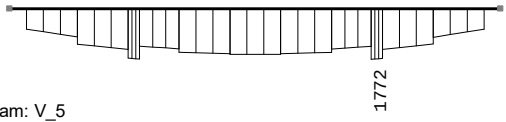
Ram: V_5
Uticaji u gredi: max T2= 65 / min T2= -65 kN

Opt. 9: T-31



Ram: V_5
Uticaji u gredi: max N1= 50 / min N1= -122 kN

Opt. 10: dt+12.3

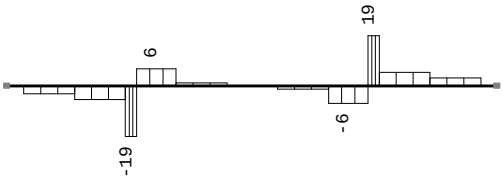


Ram: V_5
Uticaji u gredi: max M3= 1772 / min M3= -164 kNm

Opt. 10: dt+12.3

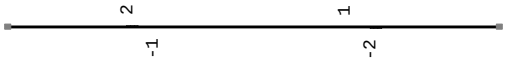
Ram: V_5
Uticaji u gredi: max M2= 453 / min M2= -454 kNm

Opt. 10: dt+12.3



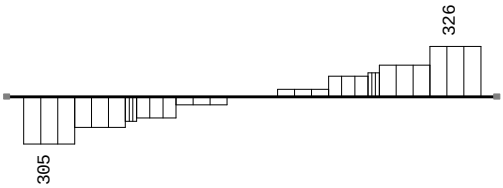
Ram: V_5
Uticaji u gredi: max M1= 19 / min M1= -19 kNm

Opt. 10: dt+12.3



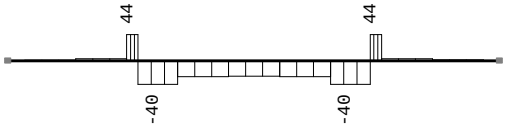
Ram: V_5
Uticaji u gredi: max T3= 84 / min T3= -84 kN

Opt. 10: dt+12.3



Ram: V_5
Uticaji u gredi: max T2= 326 / min T2= -305 kN

Opt. 10: dt+12.3



Ram: V_5
Uticaji u gredi: max N1= 86 / min N1= -40 kN

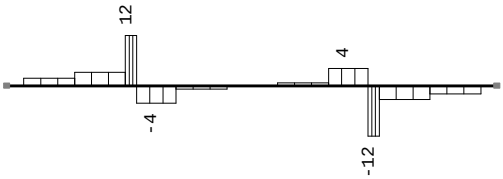
Opt. 11: dt-8

Ram: V_5
Uticaji u gredi: max M3= 107 / min M3= -1153 kNm

Opt. 11: dt-8

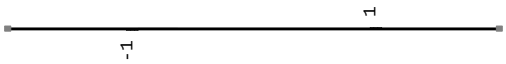
Ram: V_5
Uticaji u gredi: max M2= 295 / min M2= -295 kNm

Opt. 11: dt-8



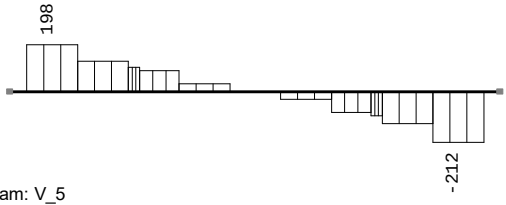
Ram: V_5
Uticaji u gredi: max M1= 12 / min M1= -12 kNm

Opt. 11: dt-8



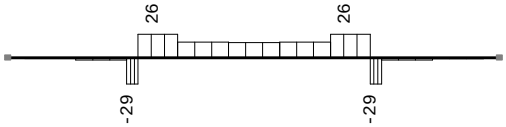
Ram: V_5
Uticaji u gredi: max T3= 55 / min T3= -55 kN

Opt. 11: dt-8



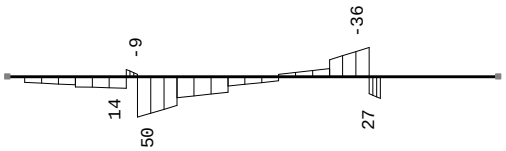
Ram: V_5
Uticaji u gredi: max T2= 198 / min T2= -212 kN

Opt. 11: dt-8



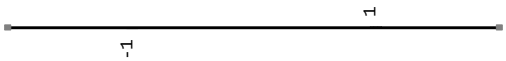
Ram: V_5
Uticaji u gredi: max N1= 26 / min N1= -56 kN

Opt. 12: Vetar



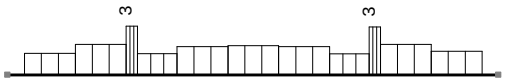
Ram: V_5
Uticaji u gredi: max M3= 62 / min M3= -62 kNm

Opt. 12: Vetar



Ram: V_5
Uticaji u gredi: max M2= 71 / min M2= -57 kNm

Opt. 12: Vetar

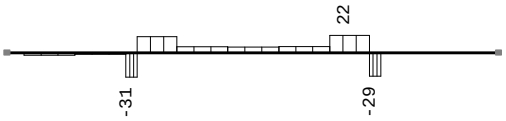


Ram: V_5
Uticaji u gredi: max M1= 3 / min M1= -3 kNm

Opt. 12: Vetar

Ram: V_5
Uticaji u gredi: max T3= 19 / min T3= -1 kN

Opt. 12: Vetar

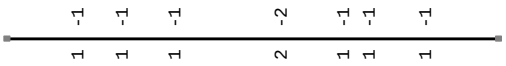


Ram: V_5
Uticaji u gredi: max T2= 64 / min T2= -31 kN

Opt. 12: Vetar

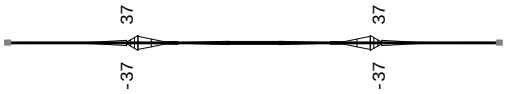
Ram: V_5
Uticaji u gredi: max N1= 64 / min N1= -64 kN

Opt. 13: Sx



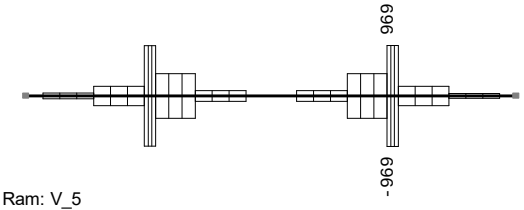
Ram: V_5
Uticaji u gredi: max M3= 1396 / min M3= -1396 kNm

Opt. 13: Sx



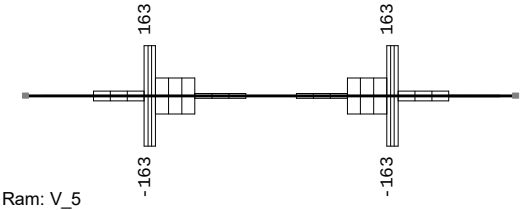
Ram: V_5
Uticaji u gredi: max M2= 251 / min M2= -251 kNm

Opt. 13: Sx



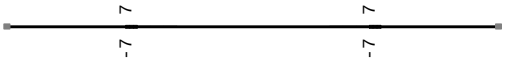
Ram: V_5
Uticaji u gredi: max M1= 969 / min M1= -969 kNm

Opt. 13: Sx



Ram: V_5
Uticaji u gredi: max T3= 163 / min T3= -163 kN

Opt. 13: Sx

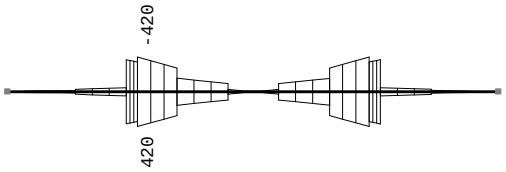


Ram: V_5
Uticaji u gredi: max T2= 233 / min T2= -233 kN

Opt. 13: Sx

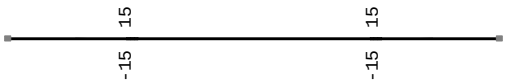
Ram: V_5
Uticaji u gredi: max N1= 9 / min N1= -9 kN

Opt. 14: Sy



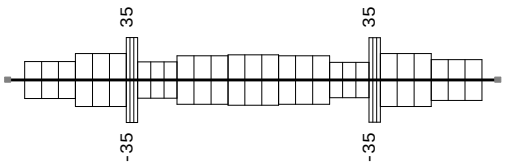
Ram: V_5
Uticaji u gredi: max M3= 610 / min M3= -610 kNm

Opt. 14: Sy



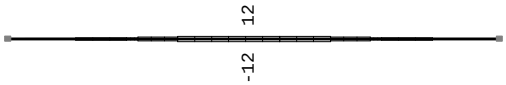
Ram: V_5
Uticaji u gredi: max M2= 842 / min M2= -842 kNm

Opt. 14: Sy



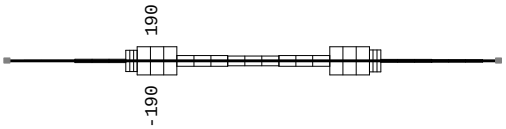
Ram: V_5
Uticaji u gredi: max M1= 42 / min M1= -42 kNm

Opt. 14: Sy



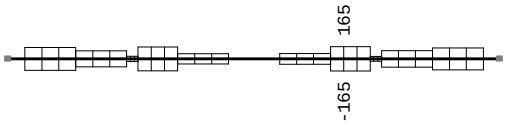
Ram: V_5
Uticaji u gredi: max T3= 222 / min T3= -222 kN

Opt. 14: Sy



Ram: V_5
Uticaji u gredi: max T2= 681 / min T2= -681 kN

Opt. 14: Sy

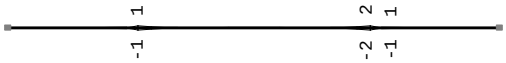


Ram: V_5
Uticaji u gredi: max N1= 684 / min N1= -684 kN

Opt. 15: Sz

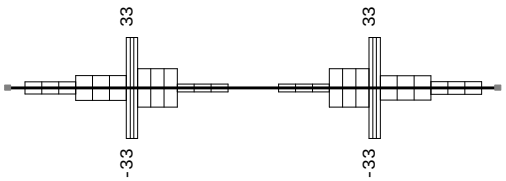
Ram: V_5
Uticaji u gredi: max M3= 267 / min M3= -267 kNm

Opt. 15: Sz



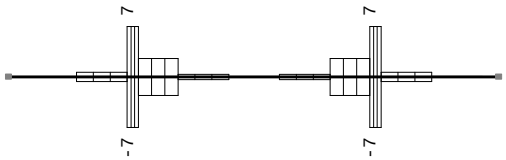
Ram: V_5
Uticaji u gredi: max M2= 37 / min M2= -37 kNm

Opt. 15: Sz



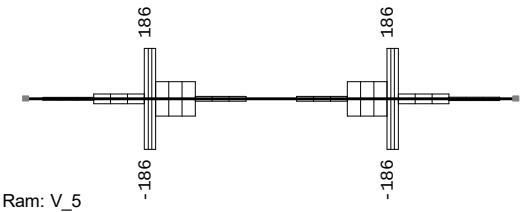
Ram: V_5
Uticaji u gredi: max M1= 33 / min M1= -33 kNm

Opt. 15: Sz



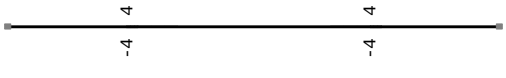
Ram: V_5
Uticaji u gredi: max T3= 7 / min T3= -7 kN

Opt. 15: Sz



Ram: V_5
Uticaji u gredi: max T2= 186 / min T2= -186 kN

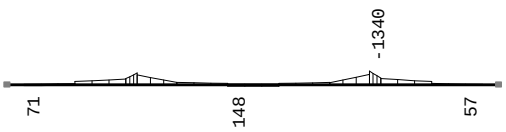
Opt. 15: Sz



Ram: V_5
Uticaji u gredi: max N1= 264 / min N1= -264 kN

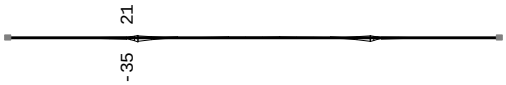
Comb1

Comb1



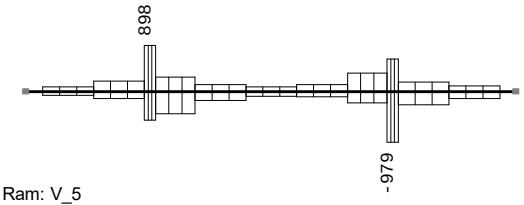
Ram: V_5
Uticaji u gredi: max M3= 4908 / min M3= -1340 kNm

Comb1



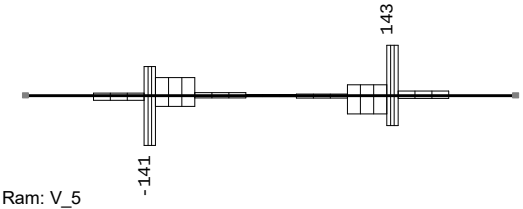
Ram: V_5
Uticaji u gredi: max M2= 437 / min M2= -413 kNm

Comb1



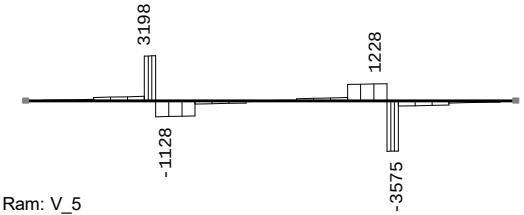
Ram: V_5
Uticaji u gredi: max M1= 898 / min M1= -979 kNm

Comb1



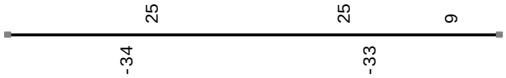
Ram: V_5
Uticaji u gredi: max T3= 143 / min T3= -141 kN

Comb1



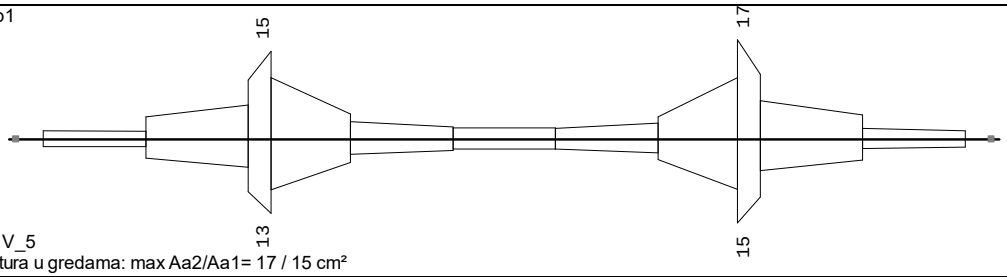
Ram: V_5
Uticaji u gredi: max T2= 3464 / min T2= -3575 kN

Comb1



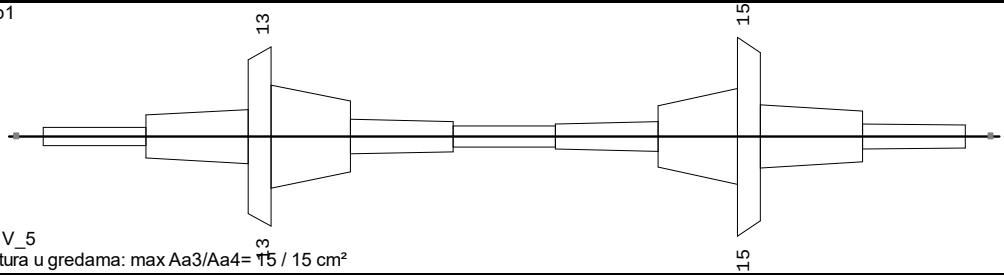
Ram: V_5
Uticaji u gredi: max N1= 25 / min N1= -5118 kN

Comb1



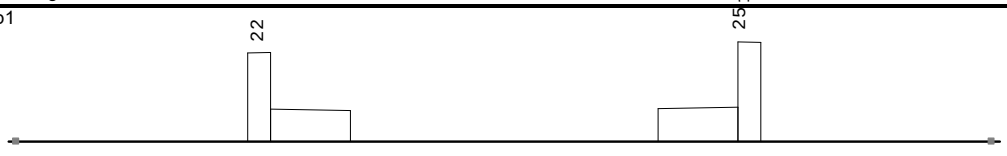
Ram: V_5
Armatura u gredama: max Aa2/Aa1= 17 / 15 cm²

Comb1



Ram: V_5
Armatura u gredama: max Aa3/Aa4= 15 / 15 cm²

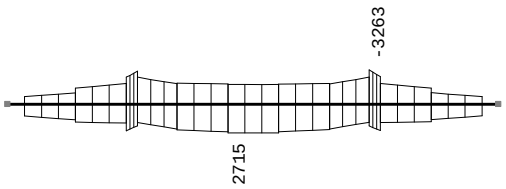
Comb1



Ram: V_5
Armatura u gredama: max Aa,uz= 25 cm²

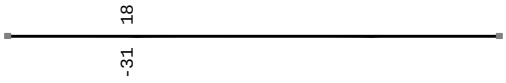
Comb2

Comb2



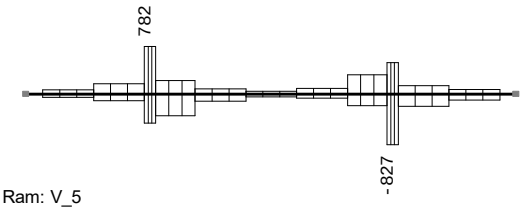
Ram: V_5
Uticaji u gredi: max M3= 4782 / min M3= -3263 kNm

Comb2



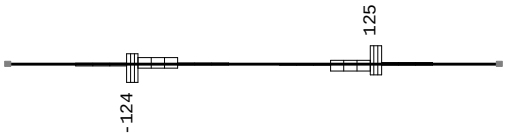
Ram: V_5
Uticaji u gredi: max M2= 1552 / min M2= -1539 kNm

Comb2



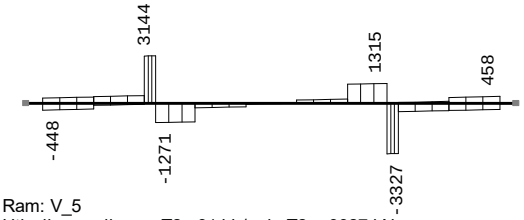
Ram: V_5
Uticaji u gredi: max M1= 782 / min M1= -827 kNm

Comb2



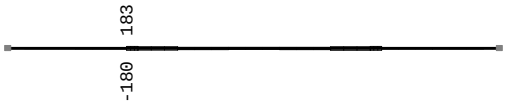
Ram: V_5
Uticaji u gredi: max T3= 334 / min T3= -344 kN

Comb2



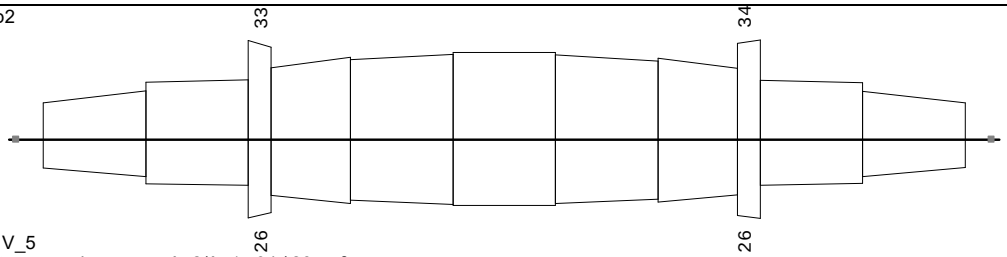
Ram: V_5
Uticaji u gredi: max T2= 3144 / min T2= -3327 kN

Comb2



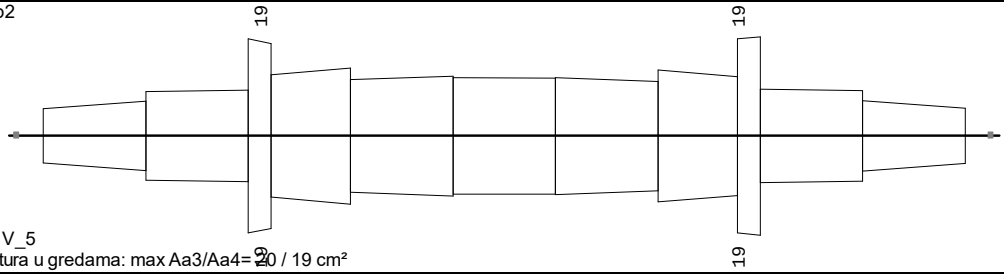
Ram: V_5
Uticaji u gredi: max N1= 294 / min N1= -4520 kN

Comb2



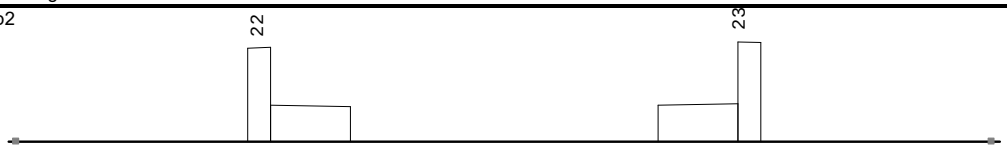
Ram: V_5
Armatura u gredama: max Aa2/Aa1= 34 / 26 cm²

Comb2



Ram: V_5
Armatura u gredama: max Aa3/Aa4= 20 / 19 cm²

Comb2



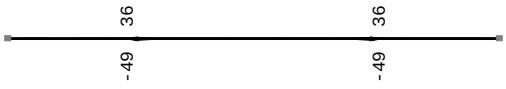
Ram: V_5
Armatura u gredama: max Aa,uz= 23 cm²

Comb3

Comb3

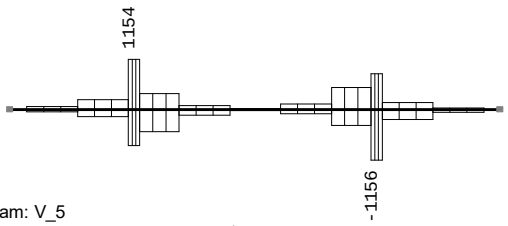
Ram: V_5
Uticaji u gredi: max M3= 3107 / min M3= -1654 kNm

Comb3



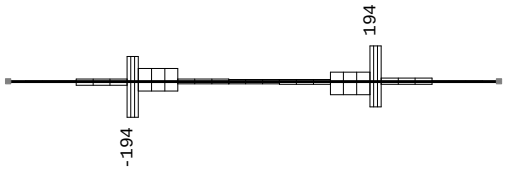
Ram: V_5
Uticaji u gredi: max M2= 1126 / min M2= -1126 kNm

Comb3



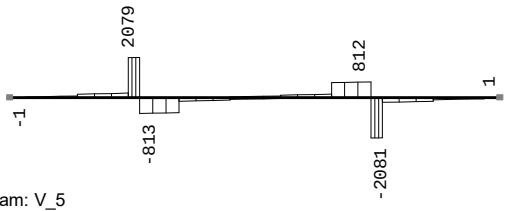
Ram: V_5
Uticaji u gredi: max M1= 1154 / min M1= -1156 kNm

Comb3



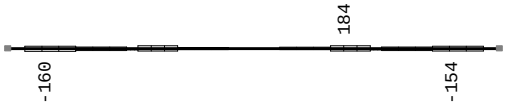
Ram: V_5
Uticaji u gredi: max T3= 276 / min T3= -276 kN

Comb3



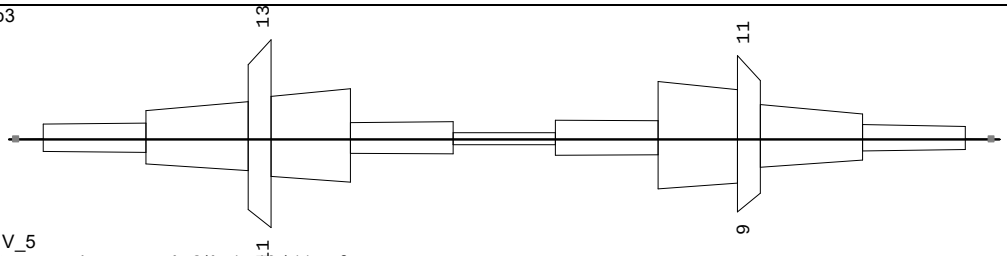
Ram: V_5
Uticaji u gredi: max T2= 2601 / min T2= -2601 kN

Comb3



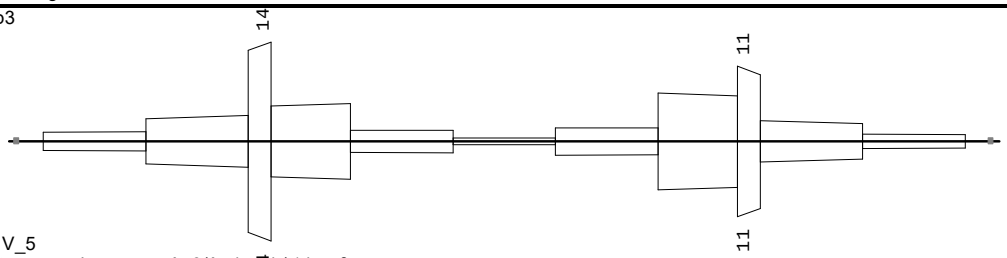
Ram: V_5
Uticaji u gredi: max N1= 238 / min N1= -3103 kN

Comb3



Ram: V_5
Armatura u gredama: max Aa2/Aa1= 13 / 11 cm²

Comb3



Ram: V_5
Armatura u gredama: max Aa3/Aa4= 14 / 14 cm²

Comb3

Ram: V_5
Armatura u gredama: max Aa,uz= 15 cm²

Потребна арматура / required reinforcement

Доња зона / Bottom side

Aa1max = 34 cm2

Горња зона / Upper side

Aa2max = 26 cm2

Бочно / Latteral side

Aa3,4max = ±19 cm2

Смичућа арматура / Shear reinforcement

Aa = 25 cm2/m

Усвојена арматура / provided reinforcement :

Вертикална арматура / Vertical reinforcement

Доња зона / Bottom side → Aa1 → 9Φ20/12.5 → Aa1 = 28.26 cm2

Горња зона / Upper side → Aa2 → 9Φ25/12.5 → Aa1 = 44.16 cm2

Бочно / Latteral side → Aa3,4 → ±6Φ20/20 → Aa1 = ±18.84 cm2

Смичућа арматура / Shear reinforcement → Aau = Φ20/15 → Aa = 20.93 cm/m

4.6. АНАЛИЗА СУБСТРУКТУРЕ

SUBSTRUCTURE ANALYSIS

4.6.1 **Анализа оптерецења /** Load analyses

Размарана су следећа оптерећења / The following loads were considered :

- **G – Сопствена тежина /** Self weight
- **dG – Додатно стално оптерећење /** Superimposed load
- **Sk – Скупљање /** Creep
- **TS - Двоосовински тандем систем концентрисаних сила /** Tandem system
- **UDL - једнакоподељено површинско оптерећење /** uniformly distributed load
- **K – Силе кочења /** Braking forces
- **T – Температурна промена** / Uniform temperature change
- **dT – Температурна разлика** / Linear temperature change
- **W – Ветар** / wind
- **Sx,y,z – Сеизмика /** Seizmic load

Kombinacije opterećenja / Load combinations :

Comb1 → Доминантно возило / Dominant live load

$$\sum = 1.35(G+dG) + 1.0Sk + 1.35Ts + 1.35UDL + 1.35K + 0.9W$$

Comb2 → Доминантна температура / Dominant temperature load

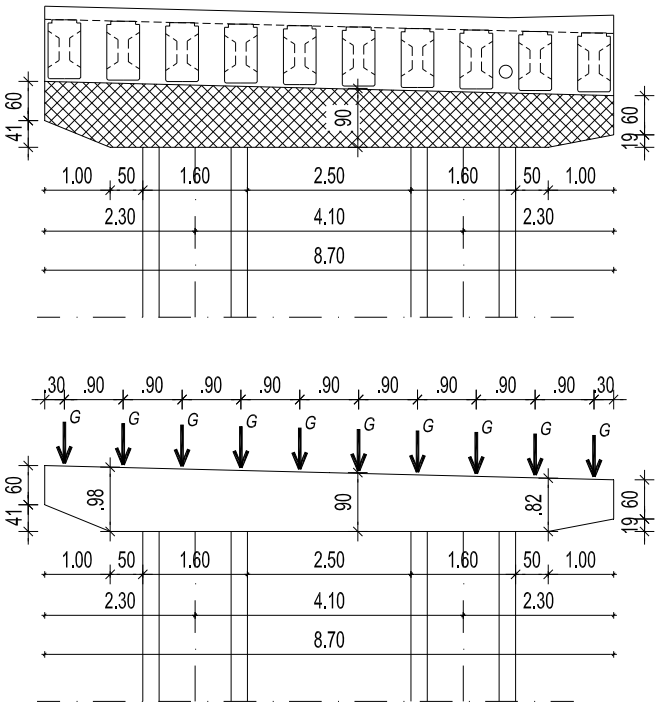
$$\sum = 1.35(G+dG) + 1.0Sk + 1.01Ts + 0,54UDL + 0,54K + 1.5W + 1.5T$$

Comb3 → Доминантна сеизмика / Dominant seizmic load

$$\sum = 1.0(G+dG) + 1.0Sk + 1.0(20\%)UDL + 1.0Si + 0.3Sik$$

4.6.2 **Лежишна греда /** Bearing beam

Фаза градње / Construction stage



Анализа оптерецења / Load analyses

Сопствена тежина / Self weight **(Лежишна греда /** Bearing beam**)**

Сопствена тежина лежишне греде је узет у обзир у прорачуну аутоматски у програмском пакету.

Self weight of bearing beam will be taken into account automaticaly by design software.

Оптерећење монтажног носача / precast girder load

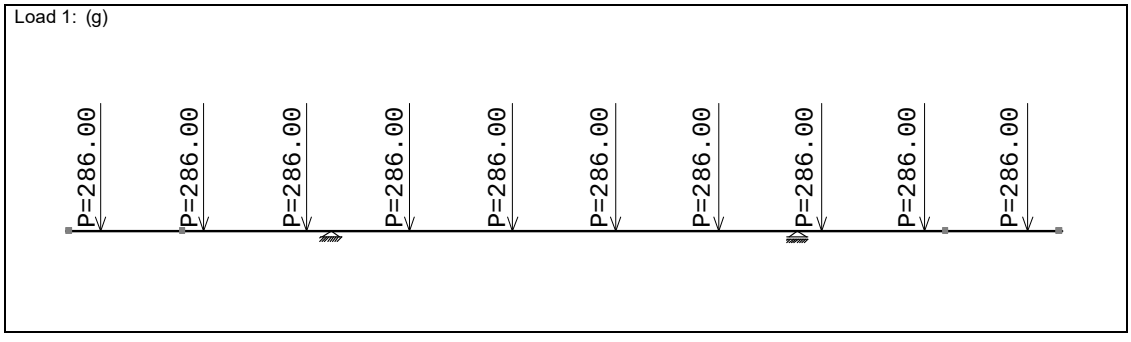
G1 = 92x2 = 184 kN

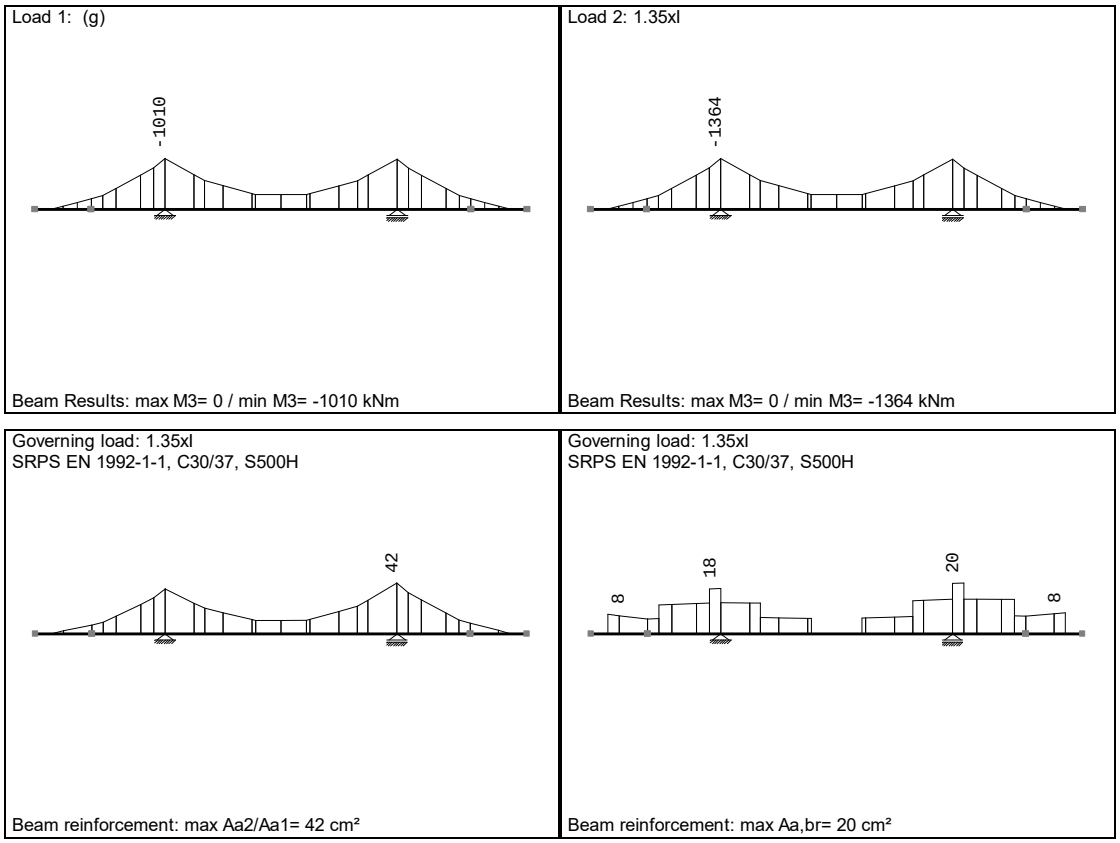
Оптерећење коловозне плоче – свеж бетон / deck load – wet concrete

G2 = 51x2 = 102 kN

Укупно / Total

G = 166+102 = 286 kN





Потребна арматура / required reinforcement

Подужна арматура / Longitudinal reinforcement

Доња зона / Bottom zone

Aa = 0 cm2

Горња зона / Upper zone

Aa = 42 cm2

Смичућа арматура / Shear reinforcement

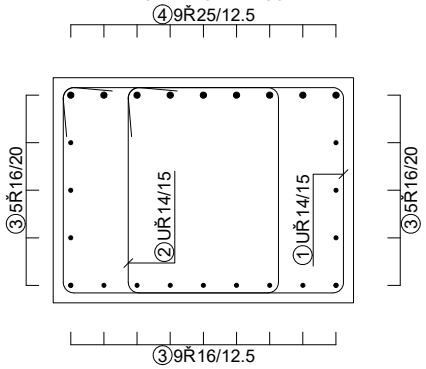
Aa = 20 cm2

Усвојена арматура / provided reinforcement :

9Φ16/12.5 → Aa = 18.09 cm2 → **Доња зона /** Bottom zone

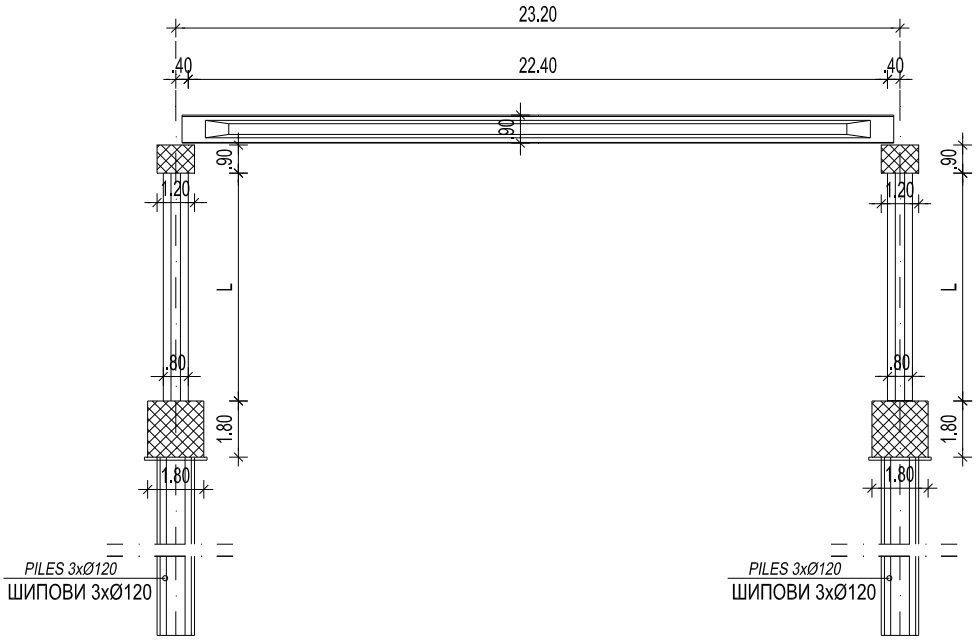
9Φ25/12.5 → Aa = 44.16 cm2 → **Горња зона /** Upper zone

2xΦ14/15 → Aa = 10.26x2 = 20.52 cm2/m → **Смичућа арматура /** Shear reinforcement



4.6.3 **Стубови /** Piers

Фаза градње / Construction stage



Сопствена тежина / Self weight

На врху стуба нема утицаја / No influence at the top of the pier

Лежишна греда/ Bearing beam

N = 7.53x1.20x25.0/2 = 113 kN

Nd = 1.00x113 = 113 kN

Монтажни носач и плоча / Pre-cast girder and deck

N = 92 +51 = 143 kN → ∑N = 10x143 = 1430 kN

Nd = 1.00x1430 = 1430 kN

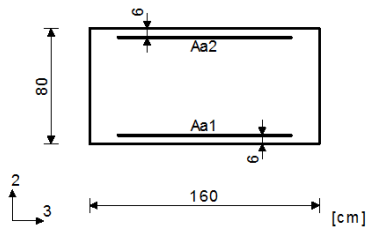
M = 1430x0.40/2 = 286 kNm (моменат од ексцентричног ослањања монтажних носача)

Md = 1.35x286 = 386 kNm

SRPS EN 1992-1-1
α,cc = 0.85
C30/37 (γC = 1.50, γS = 1.15) [PT]
S500H

M3ed = 386.00 kNm
N1ed = -1543.00 kN

Aa1 = 0.00 cm²
Aa2 = 0.00 cm²
Aa3 = 0.00 cm²
Aa4 = 0.00 cm²



Минимална арматура / Minimum reinforcement

160x80 cm → Ab = 12800 cm2

Aa,min = 0.003xAb = 0.003x12800 = 38.4 cm2

Коначна фаза / Final stage

4.6.3.1 Модална анализа / Modal analyses

Load factors for mass calculations

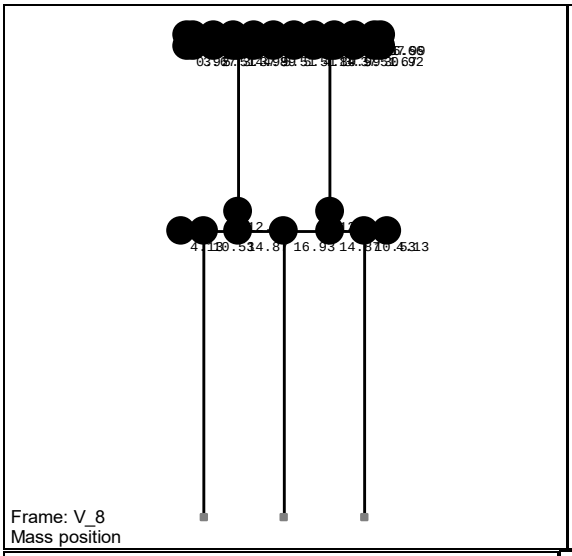
No	Name	Factor
1	Sopostvena tezina (g)	1.00
2	Dodatno stalno	1.00
3	UDL (20%)	1.00
4	Skupljanje	0.00
5	TS	0.00
6	UDL	0.00
7	Kocenje	0.00
8	T+34	0.00
9	T-31	0.00
10	dt+12.3	0.00
11	dt-8	0.00
12	Vetar	0.00

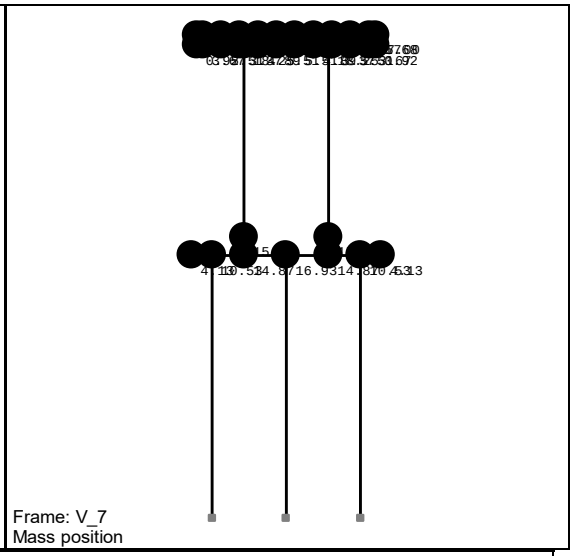
Mass distribution per levels

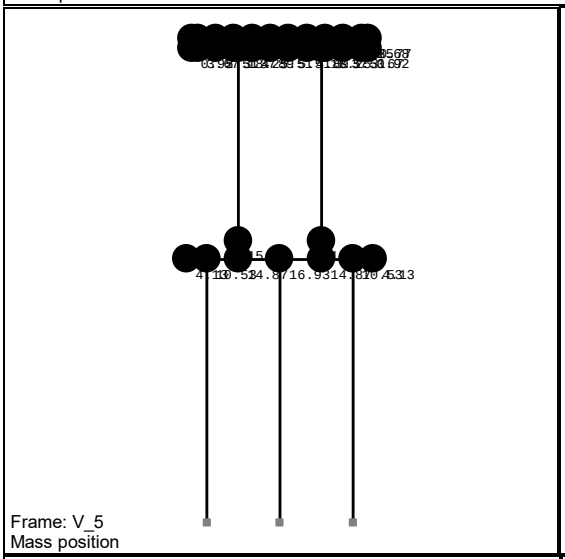
Level	Z [m]	X [m]	Y [m]	Mass [T]	T/m²
	0.00	51.45	4.35	3932.94	3.03
Total:	0.00	51.45	4.35	3932.94	

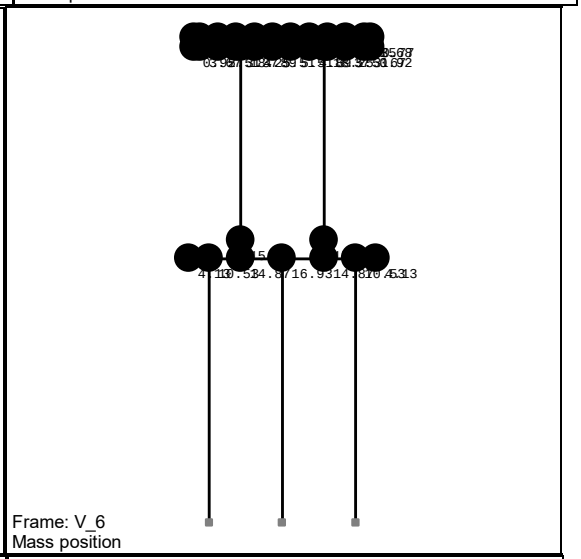
Natural frequency of structure

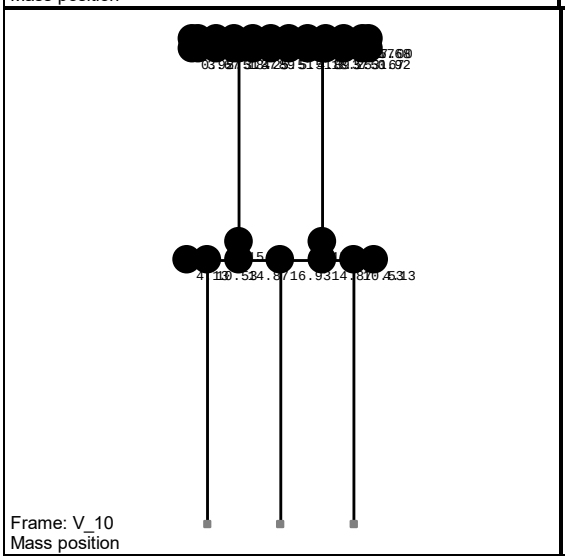
No	T [s]	f [Hz]
1	**1.1633**	**0.8596**
2	**0.6364**	**1.5714**
3	0.3254	3.0735
4	0.1741	5.7443
5	0.1717	5.8227
6	0.1708	5.8545
7	0.1687	5.9271
8	0.1659	6.0273
9	0.1432	6.9856
10	0.1430	6.9931
11	0.1411	7.0870
12	0.1390	7.1961
13	0.1347	7.4261
14	0.1329	7.5226
15	0.1315	7.6037
16	0.1315	7.6068
17	0.1314	7.6130
18	0.1309	7.6376
19	**0.1214**	**8.2369**
20	0.1204	8.3087

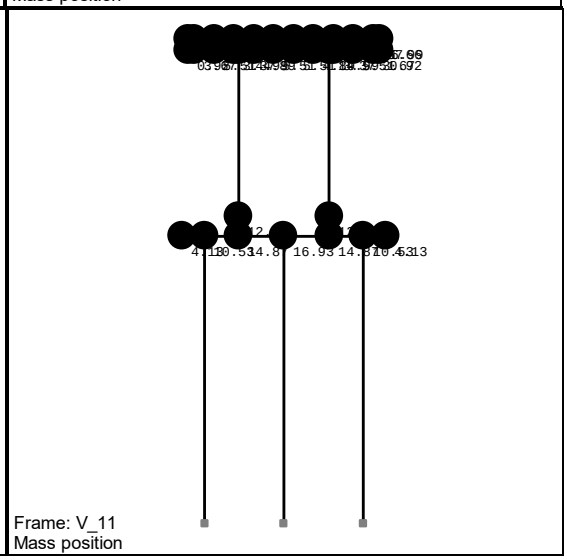

Frame: V_8
Mass position

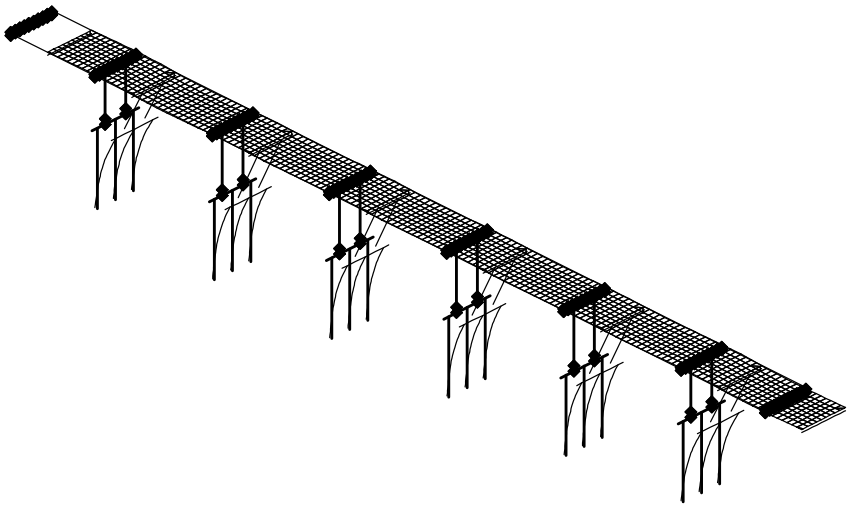

Frame: V_7
Mass position


Frame: V_5
Mass position

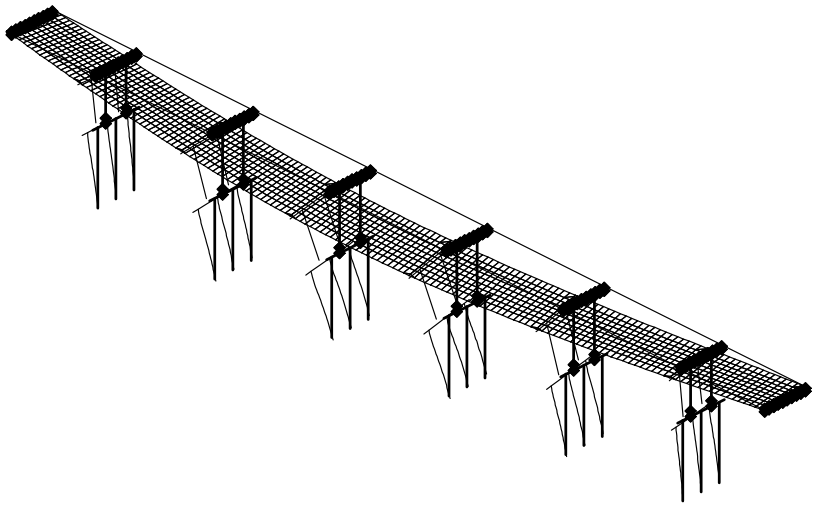

Frame: V_6
Mass position


Frame: V_10
Mass position

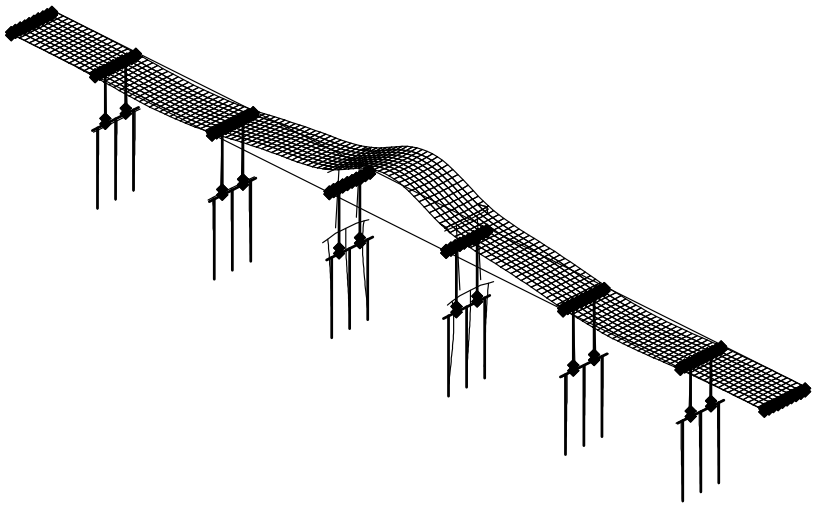

Frame: V_11
Mass position



Isometric
Modals 1/20 [T=1.1633sec / f=0.86Hz]



Isometric
Modals 2/20 [T=0.6364sec / f=1.57Hz]



Isometric
Modals 19/20 [T=0.1214sec / f=8.24Hz]

Seismic analysis: EC8 (EN 1998)

Soil category:	C
Importance factor:	II (γ=1.0)
Ratio ag/g:	0.05
Dumping coefficient:	0.05

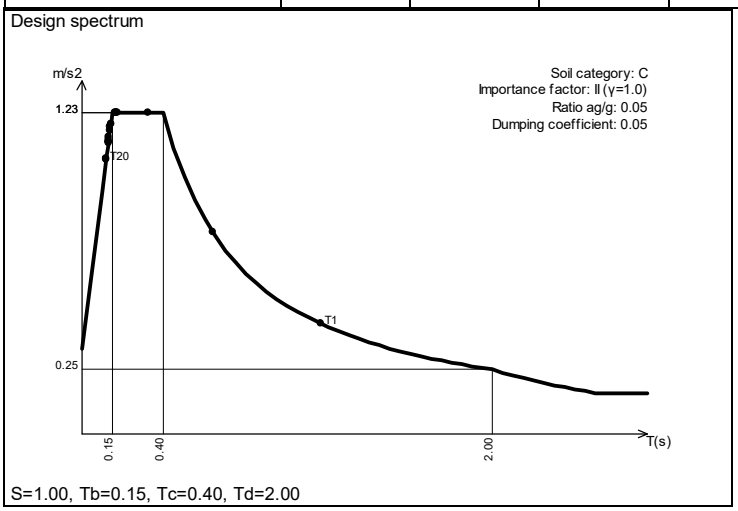
Earthquake directional factors:

Load case	Angle α[°]	k,α	k,α+90°	kz	q
Sx	0	1.000	0.000	0.000	1.000
Sy	90	1.000	0.000	0.000	1.000
Sz	0	0.000	0.000	1.000	1.000

Type of spectrum

Load case	S	Tb	Tc	Td	avg/ag
Sx	1.150	0.200	0.600	2.000	1.000
Sy	1.150	0.200	0.600	2.000	1.000
Sz	1.150	0.200	0.600	2.000	1.000

Design spectrum

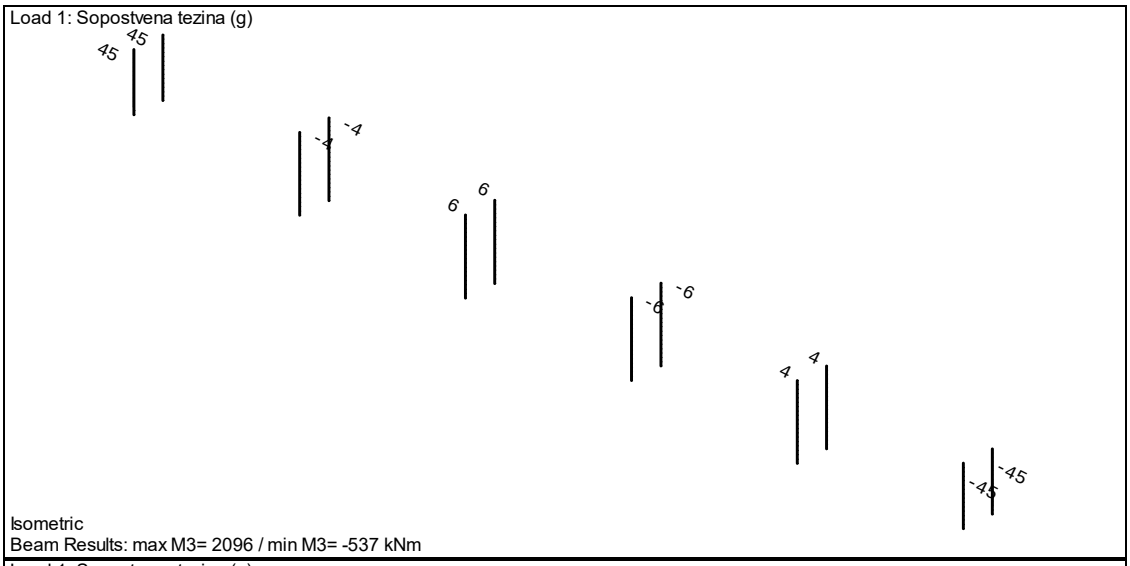


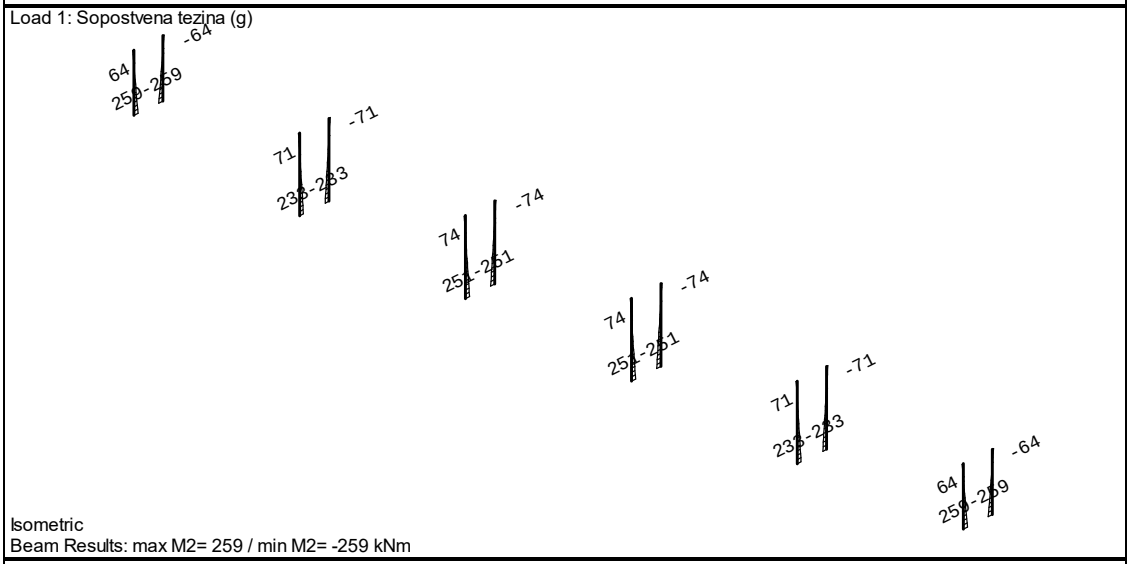
S=1.00, Tb=0.15, Tc=0.40, Td=2.00

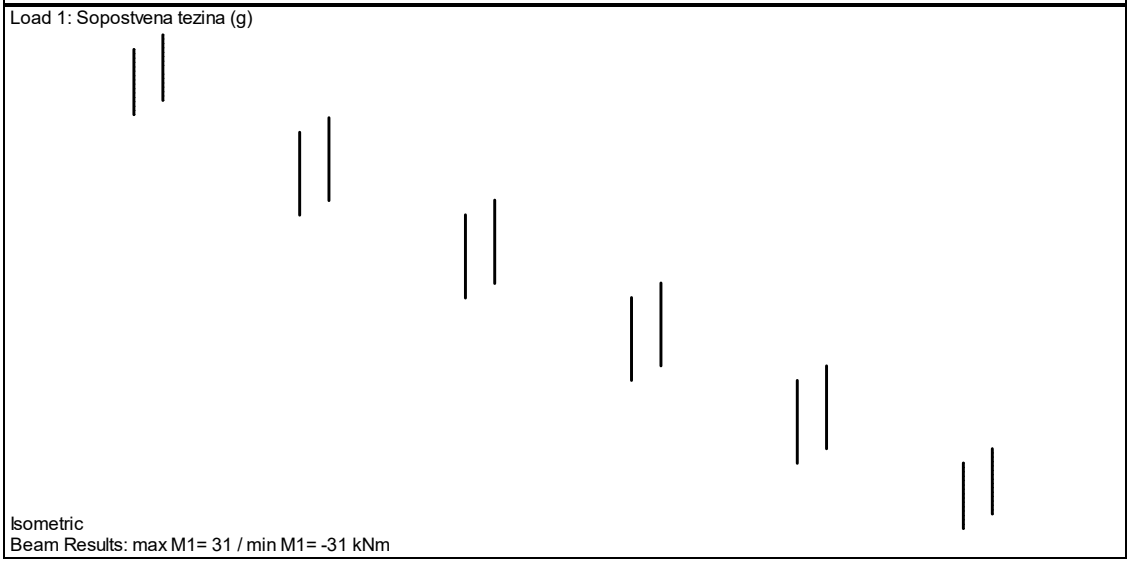
Distribution factors - mass involvement

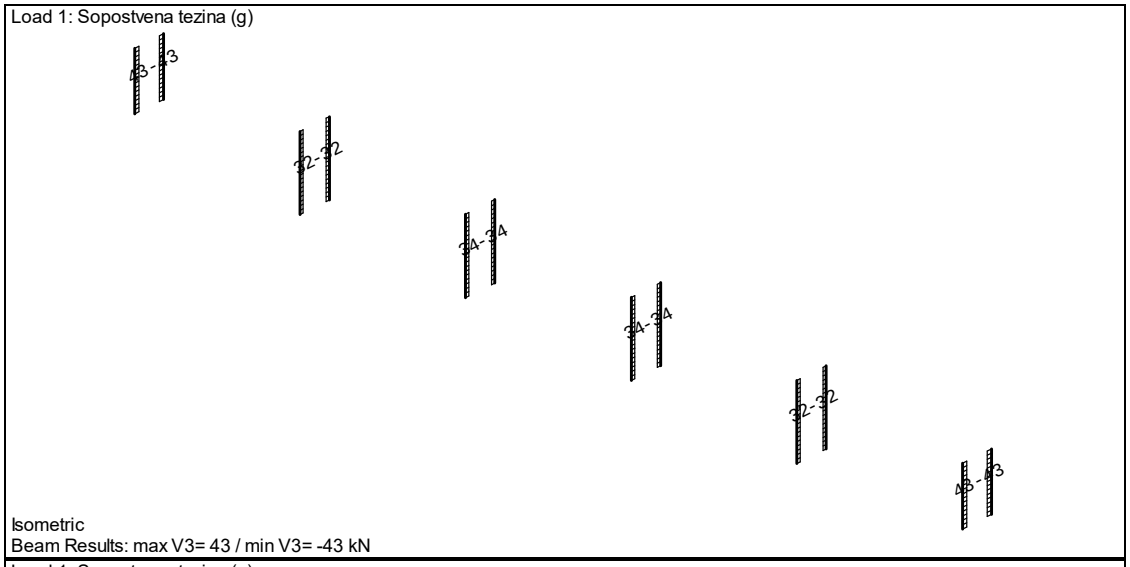
Mode	U [α=0°]	U [α=90°]	U [α=0°]	U [Z]
1	95.13	0.00	95.13	0.00
2	0.00	76.70	0.00	0.00
3	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00
5	0.00	8.11	0.00	0.00
6	0.10	0.00	0.10	0.00
7	0.00	0.00	0.00	0.00
8	3.14	0.00	3.14	0.00
9	0.00	3.01	0.00	0.00
10	0.00	0.00	0.00	0.37
11	1.62	0.00	1.62	0.00
12	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00
14	0.00	0.43	0.00	0.00
15	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00
18	0.00	0.28	0.00	0.00
19	0.00	0.00	0.00	29.03
20	0.00	0.00	0.00	0.00
ΣU (%)	99.98	88.54	99.98	29.40

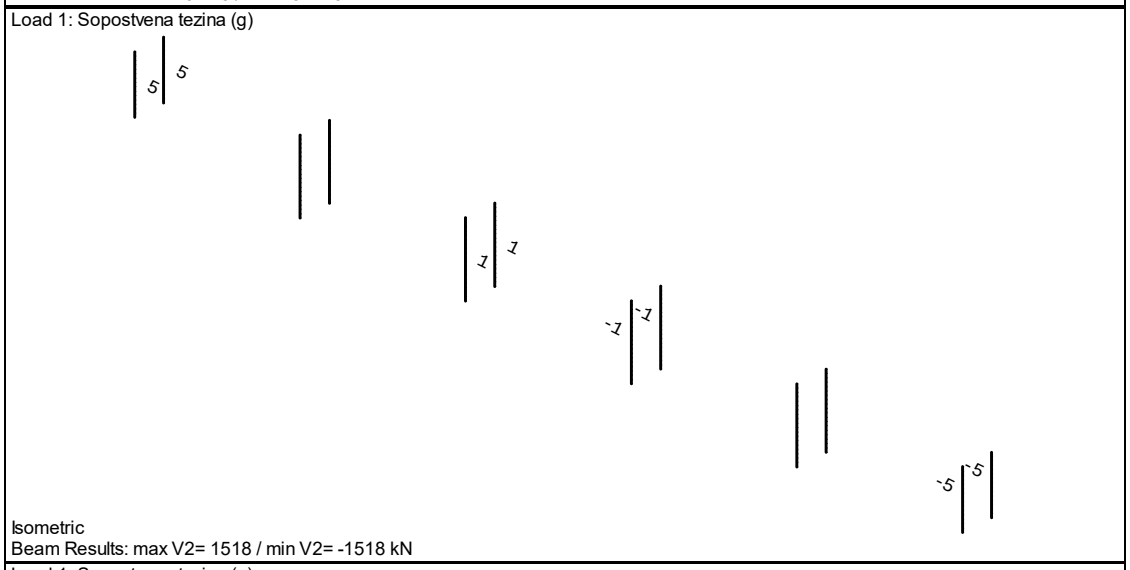
4.6.3.2 Пресечне силе и деформације / Internal forces and deformations

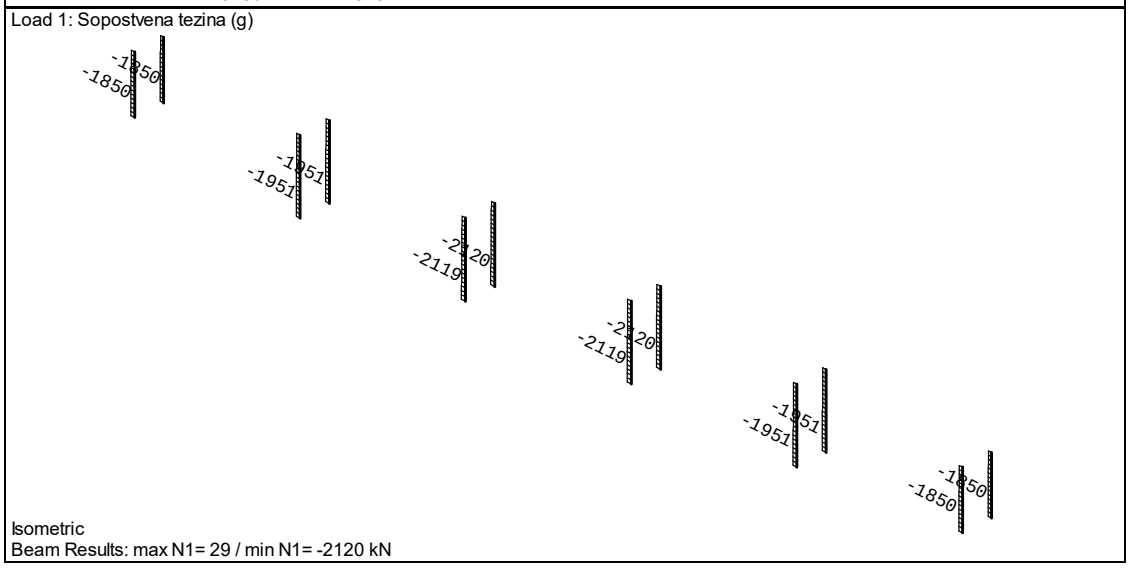

Load 1: Sopostvena tezina (g)
Isometric
Beam Results: max M3= 2096 / min M3= -537 kNm

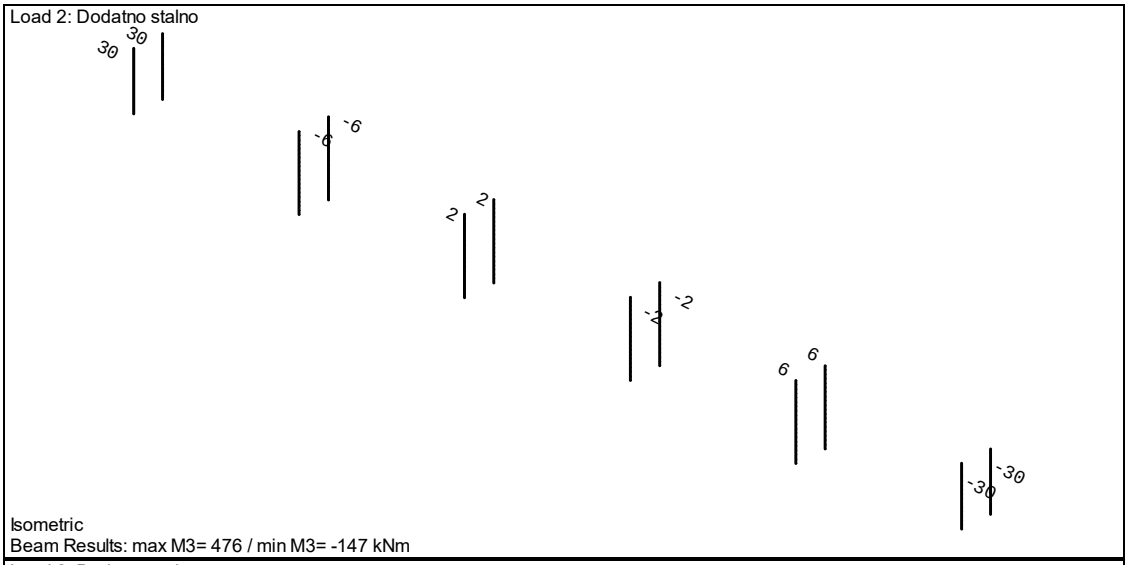

Load 1: Sopostvena tezina (g)
Isometric
Beam Results: max M2= 259 / min M2= -259 kNm

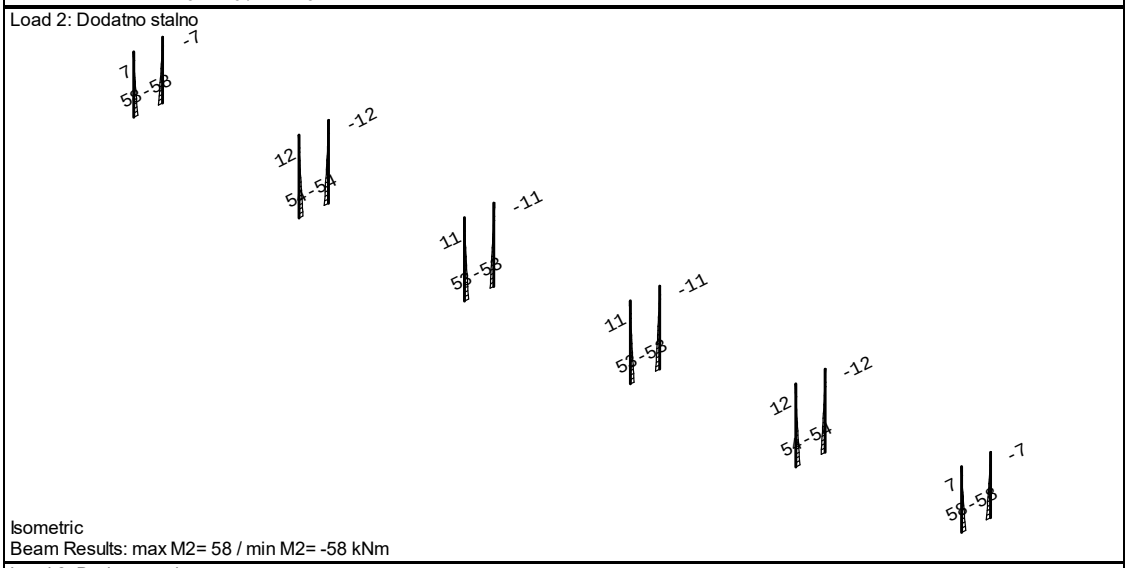

Load 1: Sopostvena tezina (g)
Isometric
Beam Results: max M1= 31 / min M1= -31 kNm

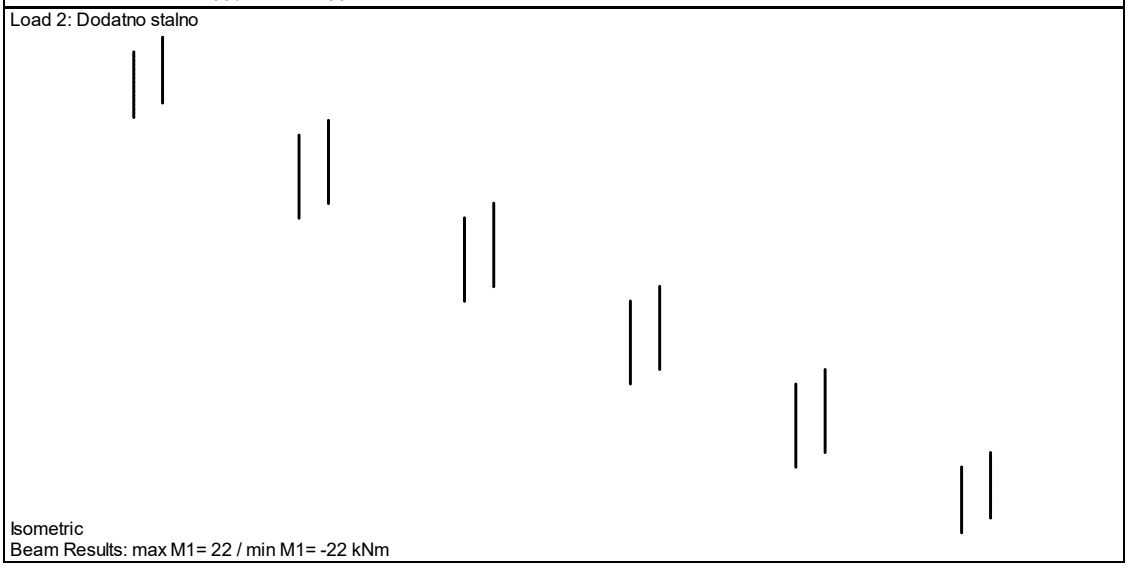

Load 1: Sopostvena tezina (g)
Isometric
Beam Results: max V3= 43 / min V3= -43 kN

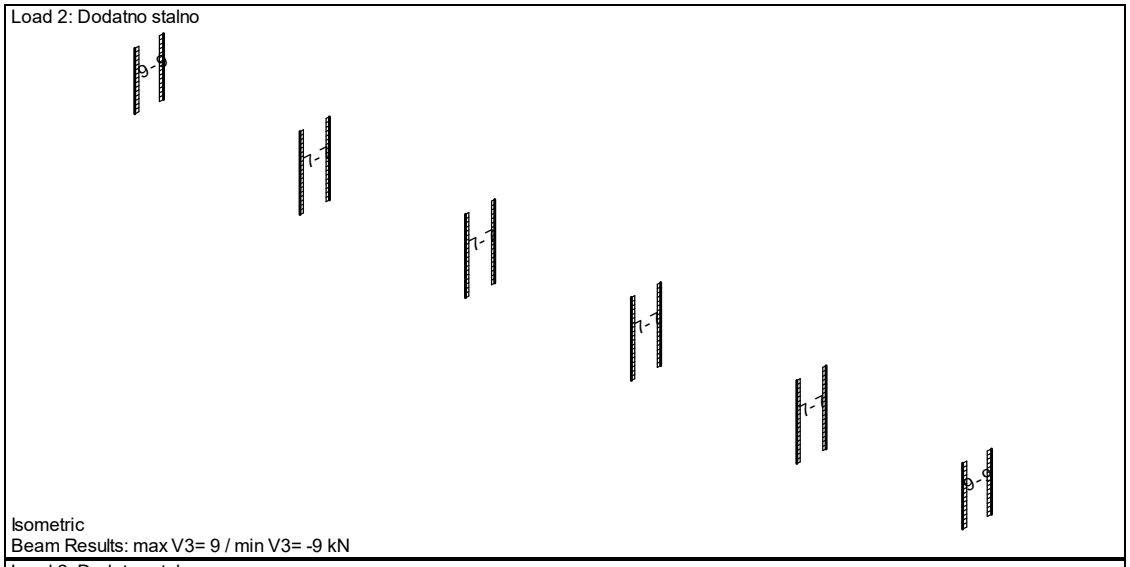

Load 1: Sopostvena tezina (g)
Isometric
Beam Results: max V2= 1518 / min V2= -1518 kN

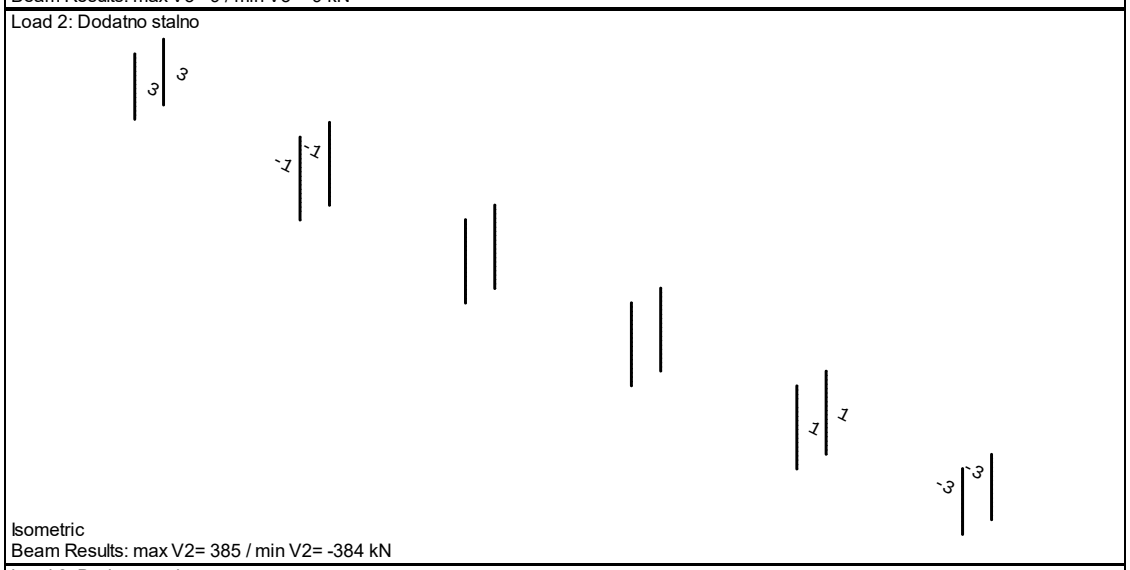

Load 1: Sopostvena tezina (g)
Isometric
Beam Results: max N1= 29 / min N1= -2120 kN

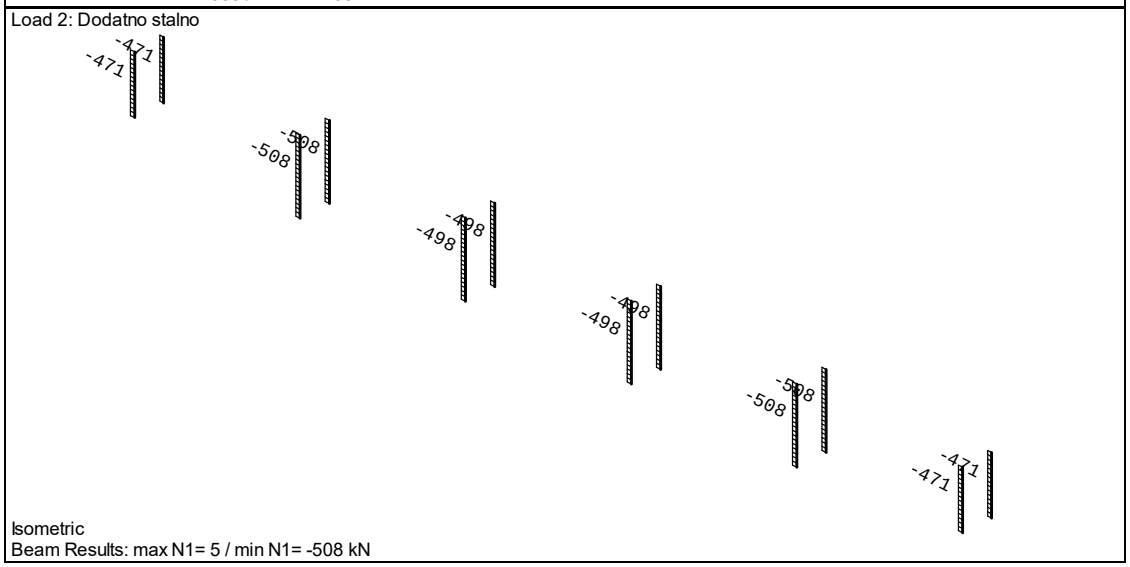

Load 2: Dodatno stalno
30
30
-6
-6
2
2
-2
-2
6
6
-30
-30
Isometric
Beam Results: max M3= 476 / min M3= -147 kNm


Load 2: Dodatno stalno
-7
7
58
-58
-12
12
54
-54
-11
11
58
-58
-11
11
58
-58
-12
12
58
-54
-7
7
58
-58
Isometric
Beam Results: max M2= 58 / min M2= -58 kNm

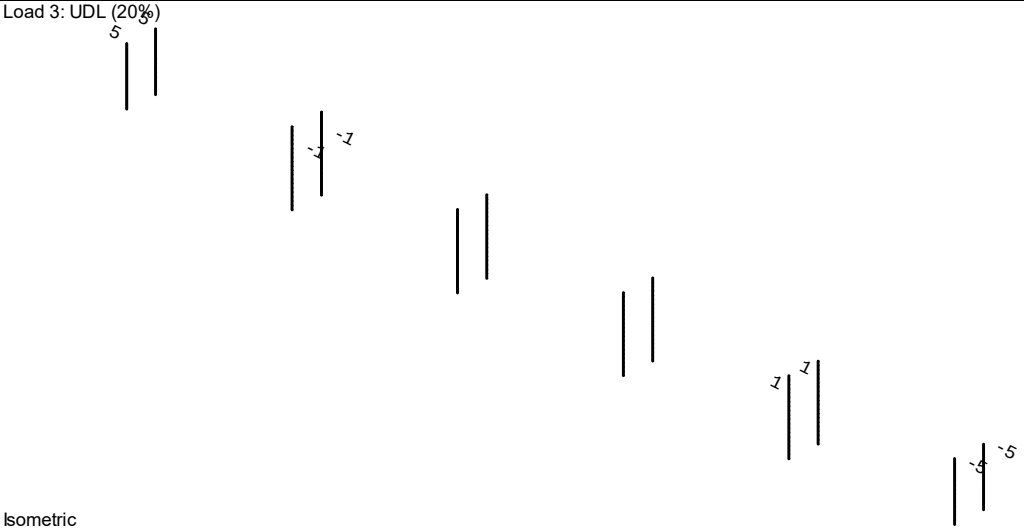

Load 2: Dodatno stalno
Isometric
Beam Results: max M1= 22 / min M1= -22 kNm


Load 2: Dodatno stalno
Isometric
Beam Results: max V3= 9 / min V3= -9 kN


Load 2: Dodatno stalno
Isometric
Beam Results: max V2= 385 / min V2= -384 kN

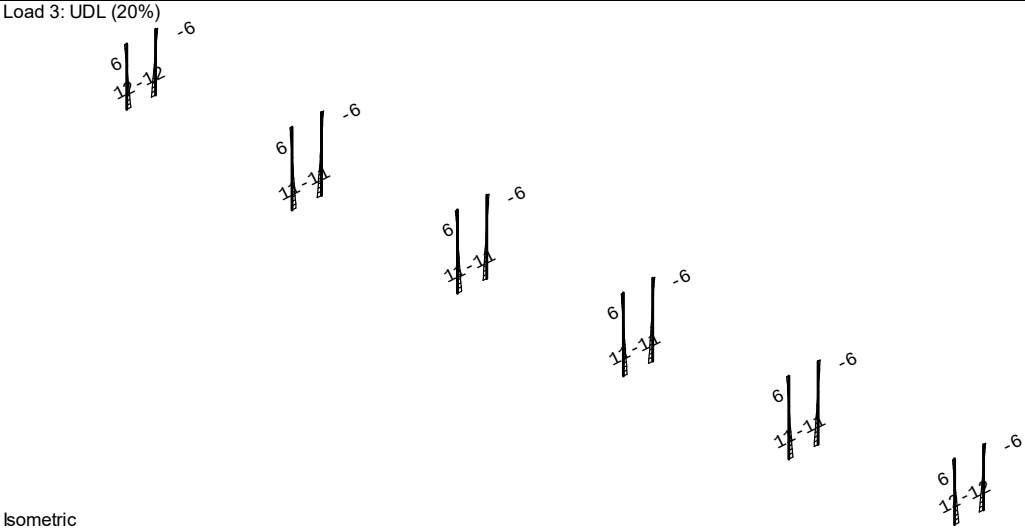

Load 2: Dodatno stalno
Isometric
Beam Results: max N1= 5 / min N1= -508 kN

Load 3: UDL (20%)



Isometric
Beam Results: max M3= 84 / min M3= -14 kNm

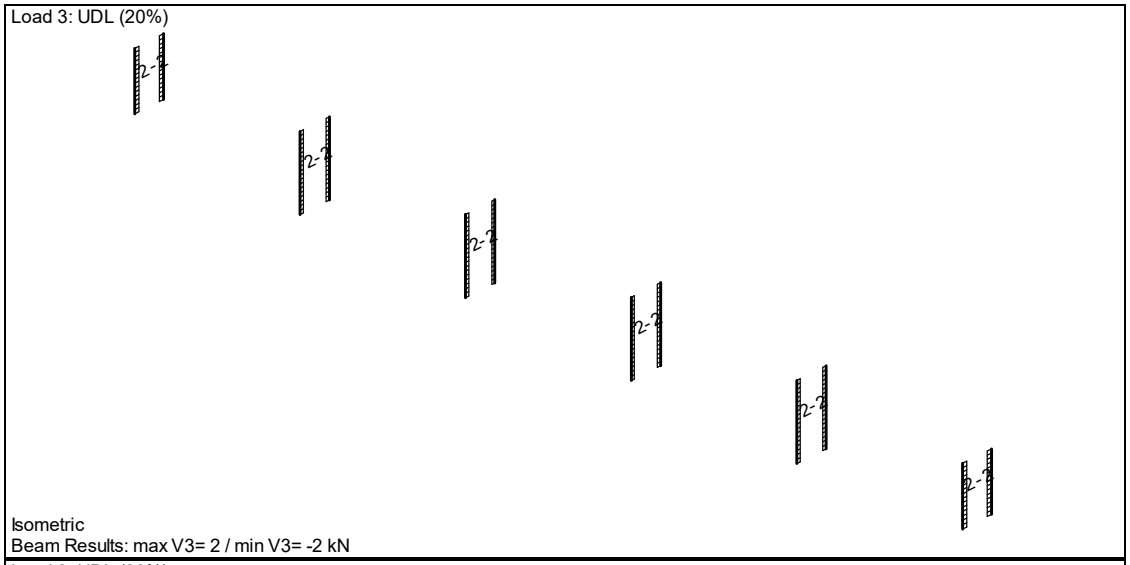
Load 3: UDL (20%)

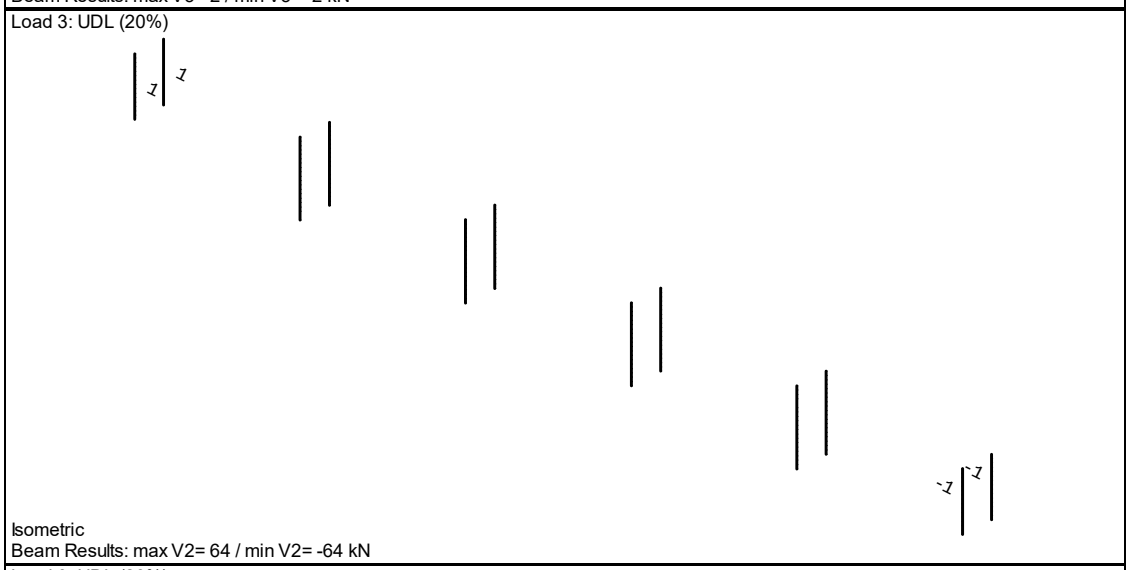


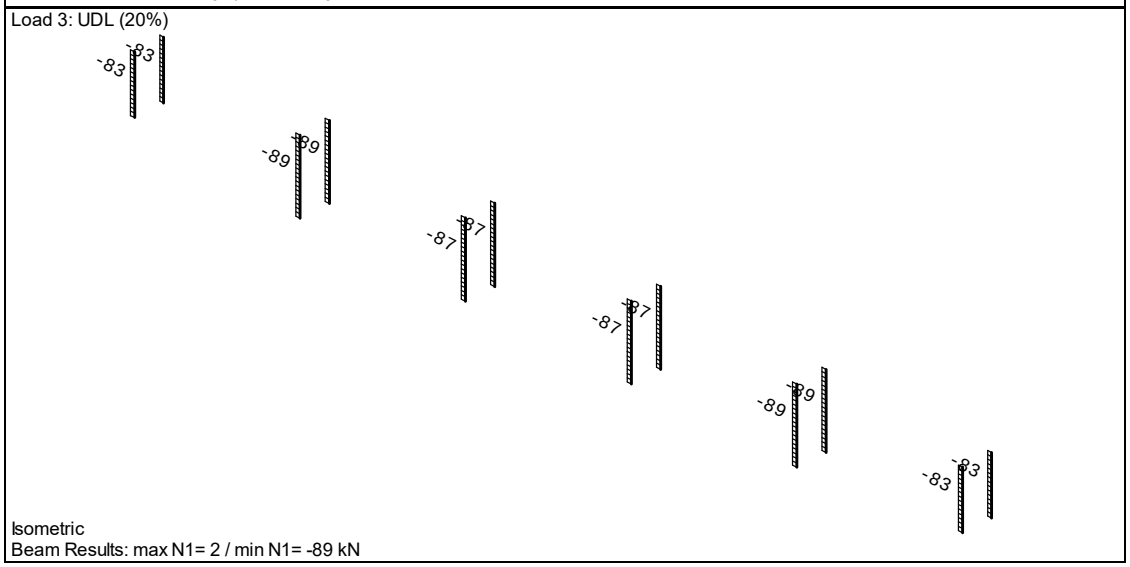
Isometric
Beam Results: max M2= 12 / min M2= -12 kNm

Load 3: UDL (20%)

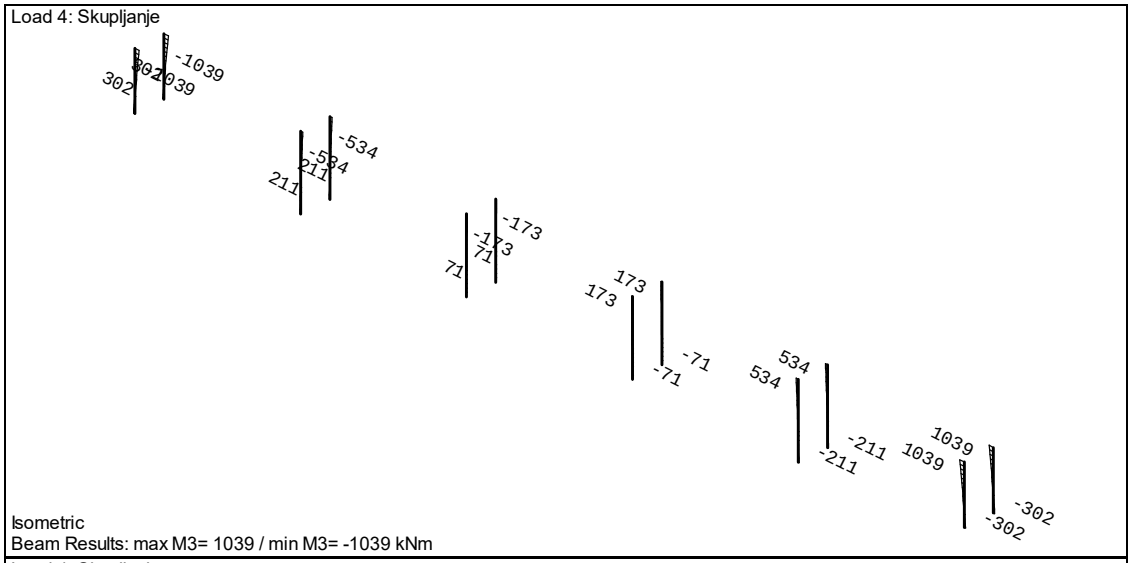
Isometric
Beam Results: max M1= 4 / min M1= -4 kNm


Load 3: UDL (20%)
Isometric
Beam Results: max V3= 2 / min V3= -2 kN


Load 3: UDL (20%)
Isometric
Beam Results: max V2= 64 / min V2= -64 kN

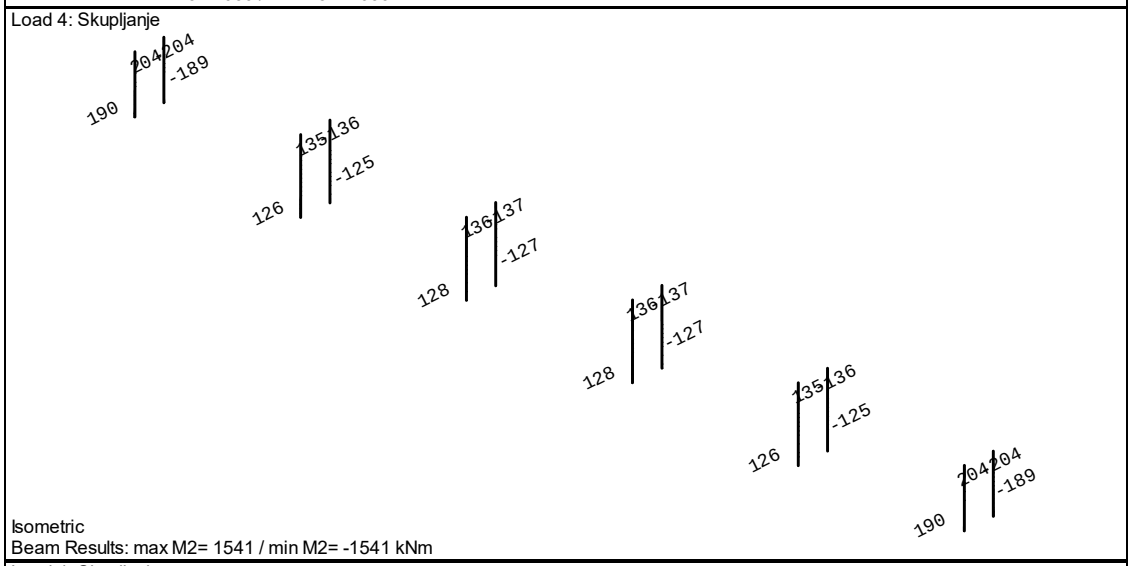

Load 3: UDL (20%)
Isometric
Beam Results: max N1= 2 / min N1= -89 kN

Load 4: Skupljanje



Isometric
Beam Results: max M3= 1039 / min M3= -1039 kNm

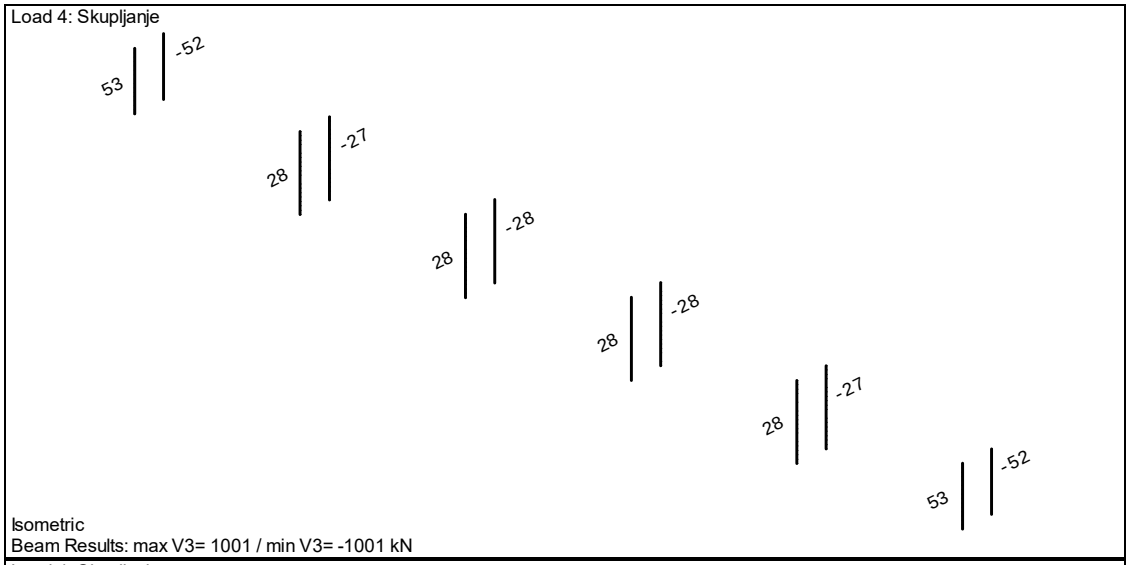
Load 4: Skupljanje

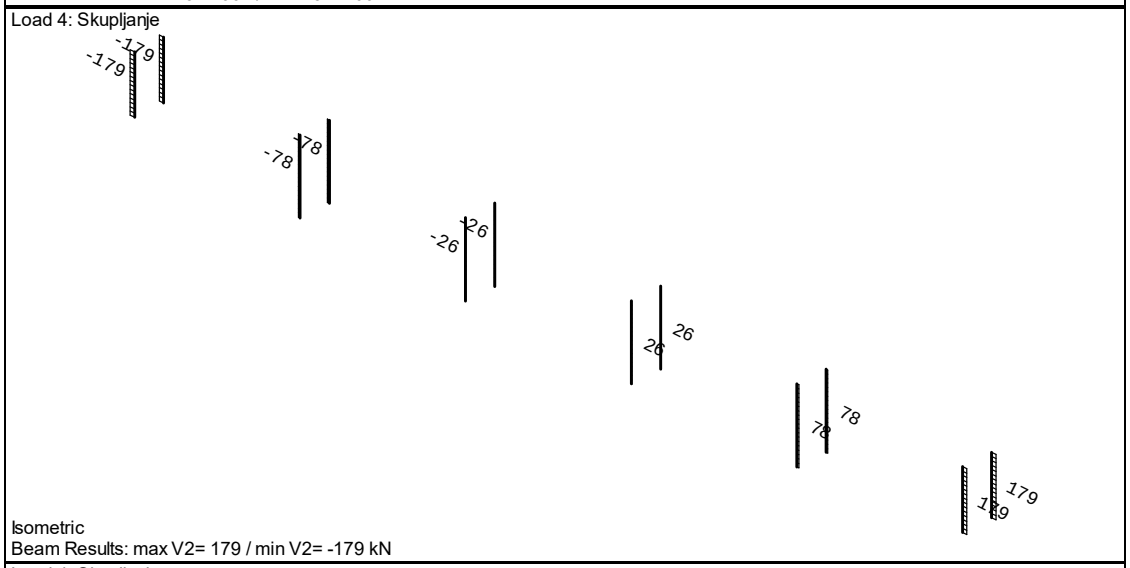


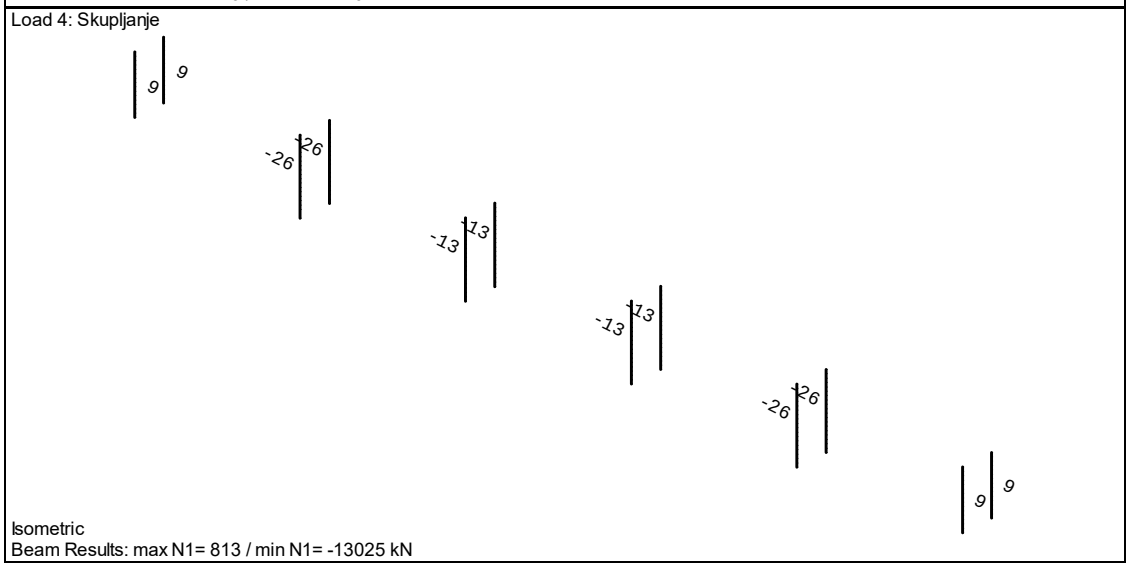
Isometric
Beam Results: max M2= 1541 / min M2= -1541 kNm

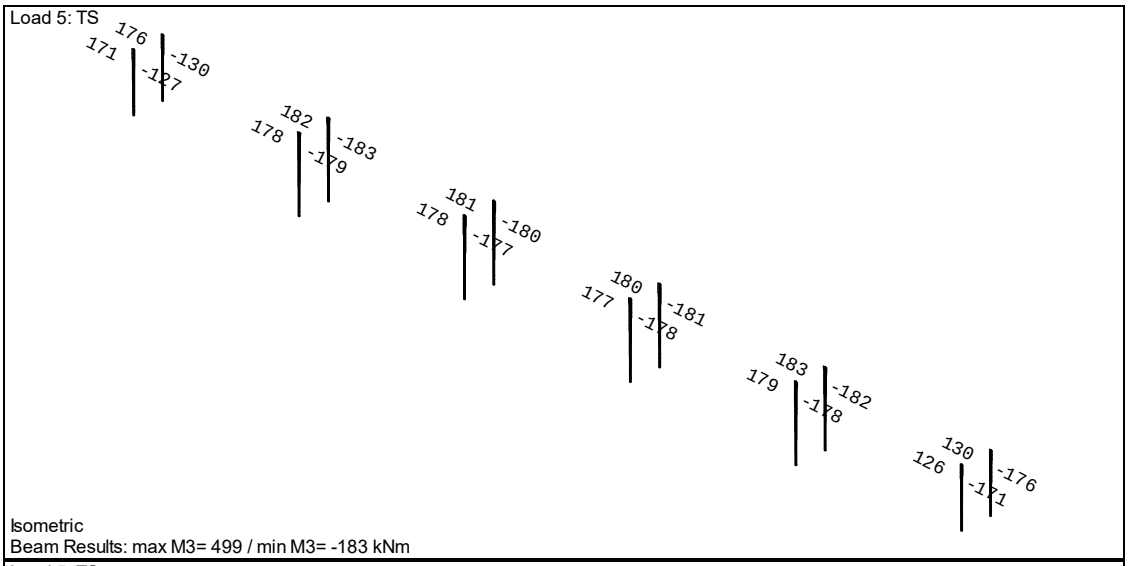
Load 4: Skupljanje

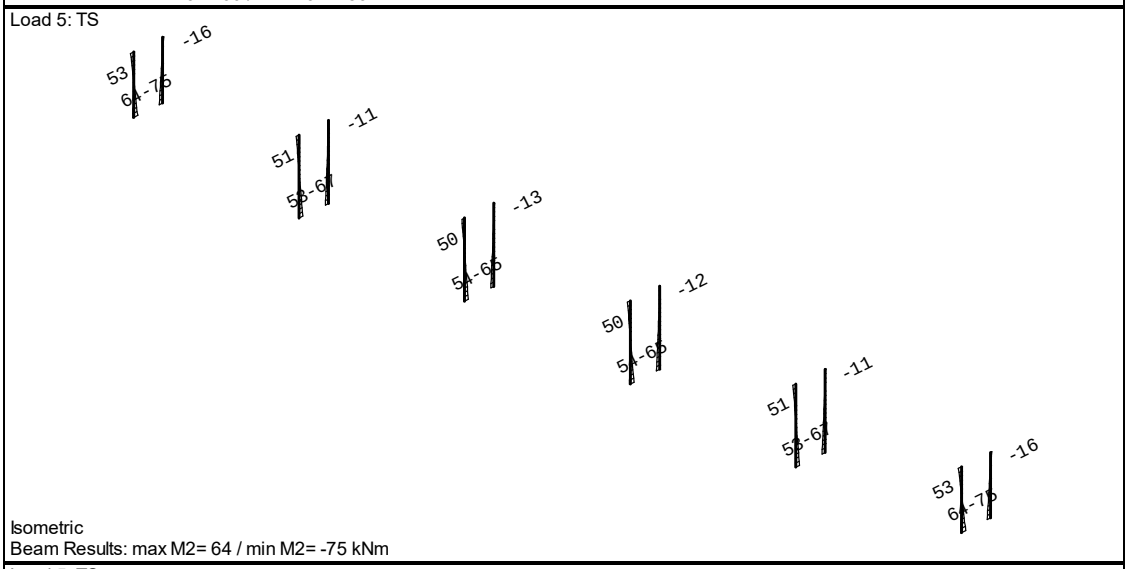
Isometric
Beam Results: max M1= 720 / min M1= -720 kNm


Load 4: Skupljanje
53
-52
28
-27
28
-28
28
-28
28
-27
53
-52
Isometric
Beam Results: max V3= 1001 / min V3= -1001 kN

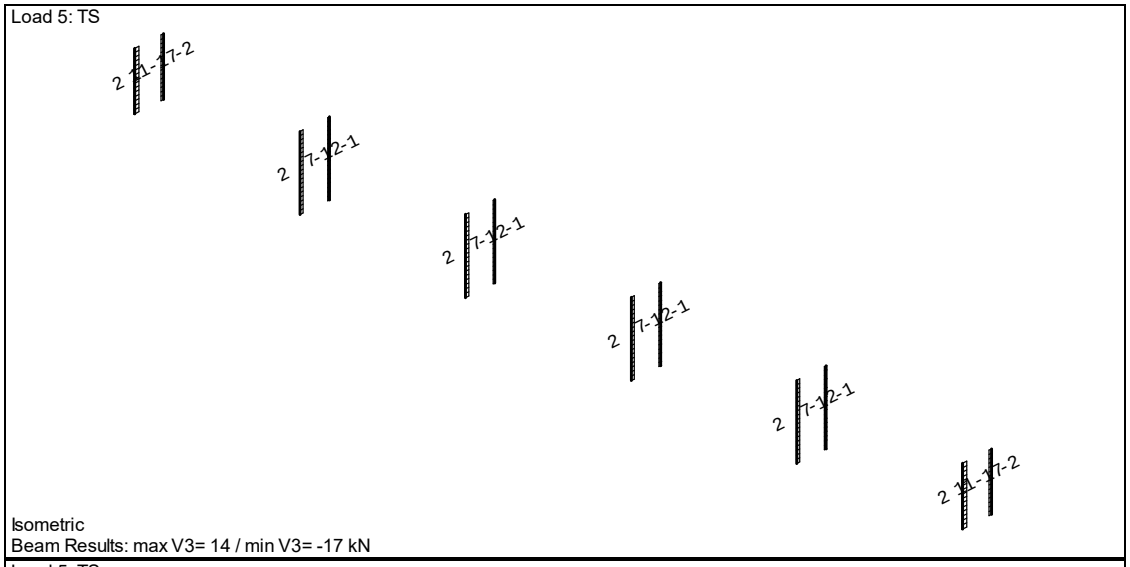

Load 4: Skupljanje
-179
179
-78
78
-26
26
26
26
78
78
179
179
Isometric
Beam Results: max V2= 179 / min V2= -179 kN

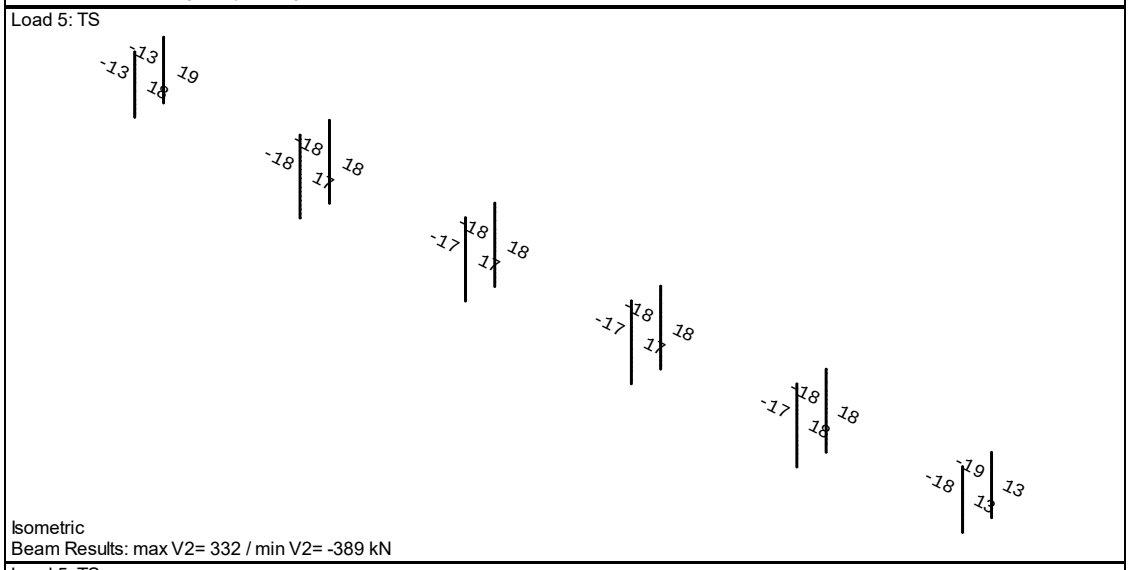

Load 4: Skupljanje
9
9
-26
26
-13
13
-13
13
-26
26
9
9
Isometric
Beam Results: max N1= 813 / min N1= -13025 kN

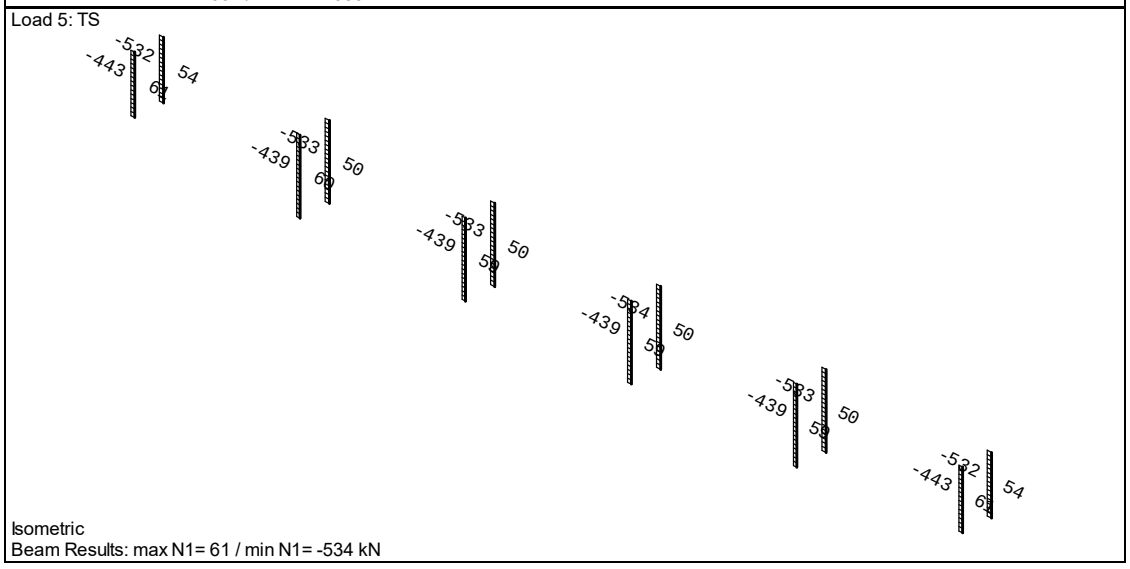

Load 5: TS
Isometric
Beam Results: max M3= 499 / min M3= -183 kNm

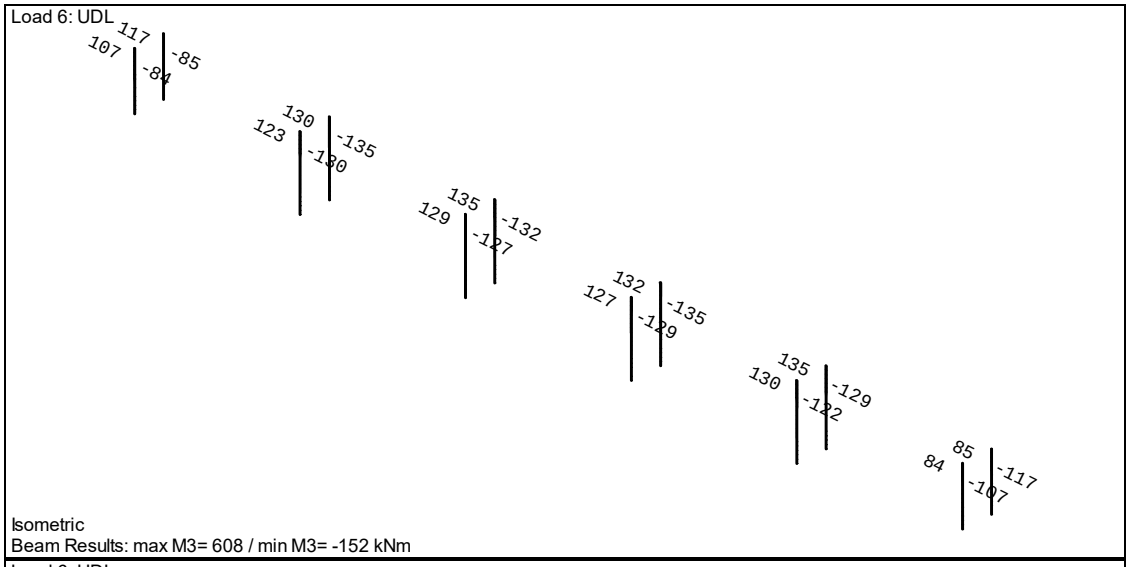

Load 5: TS
Isometric
Beam Results: max M2= 64 / min M2= -75 kNm

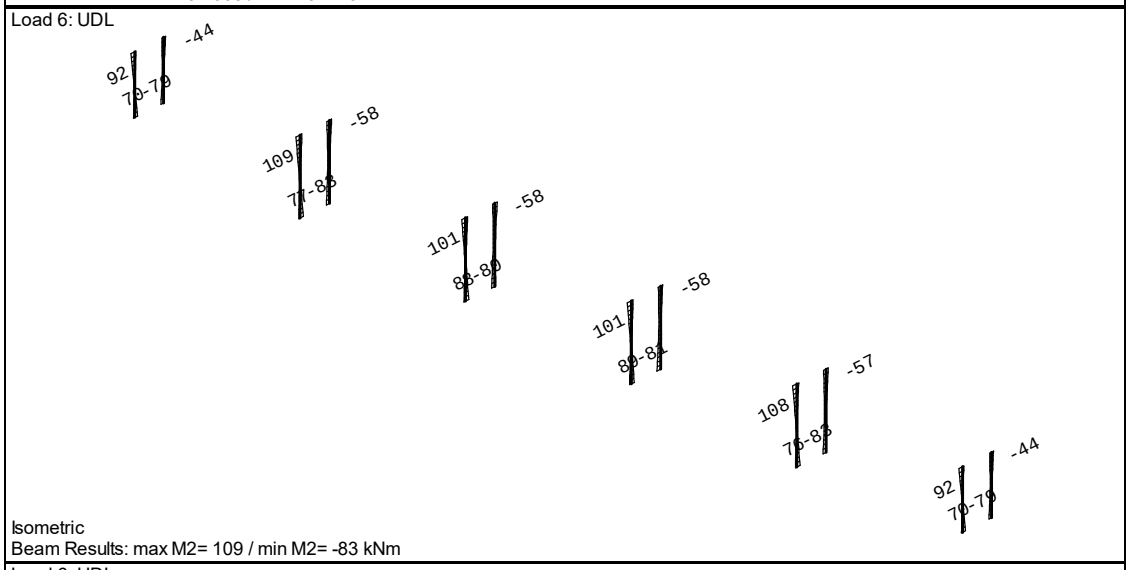
Load 5: TS
Isometric
Beam Results: max M1= 149 / min M1= -149 kNm

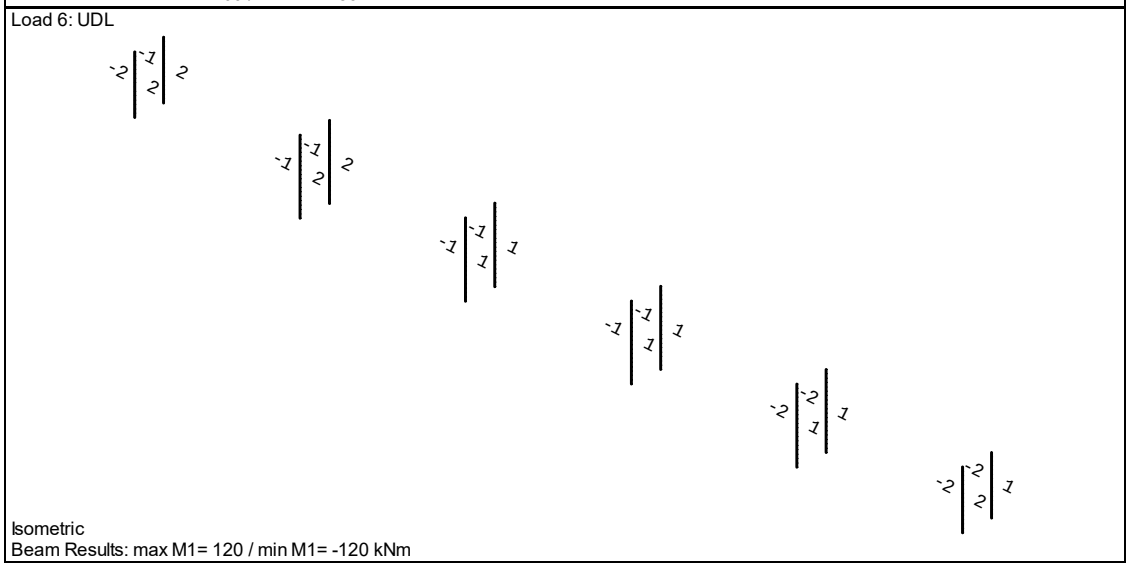

Load 5: TS
Isometric
Beam Results: max V3= 14 / min V3= -17 kN


Load 5: TS
Isometric
Beam Results: max V2= 332 / min V2= -389 kN

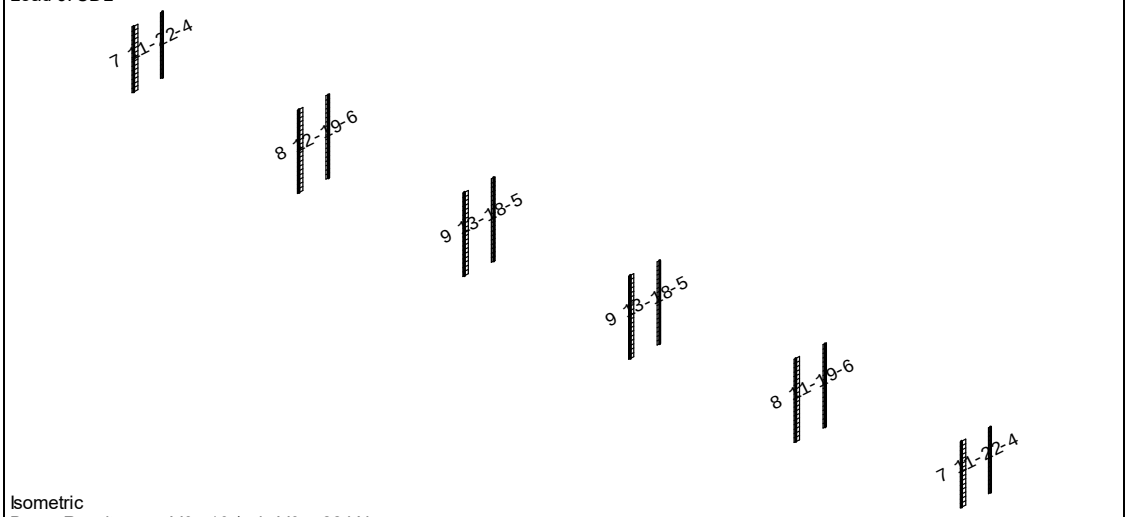

Load 5: TS
Isometric
Beam Results: max N1= 61 / min N1= -534 kN


Load 6: UDL
117
107
-84
-85
130
123
-130
-135
135
129
-127
-132
132
127
-129
-135
135
130
-122
-129
85
84
-107
-117
Isometric
Beam Results: max M3= 608 / min M3= -152 kNm


Load 6: UDL
92
70-79
-44
109
77-85
-58
101
88-89
-58
101
80-81
-58
108
76-83
-57
92
70-79
-44
Isometric
Beam Results: max M2= 109 / min M2= -83 kNm

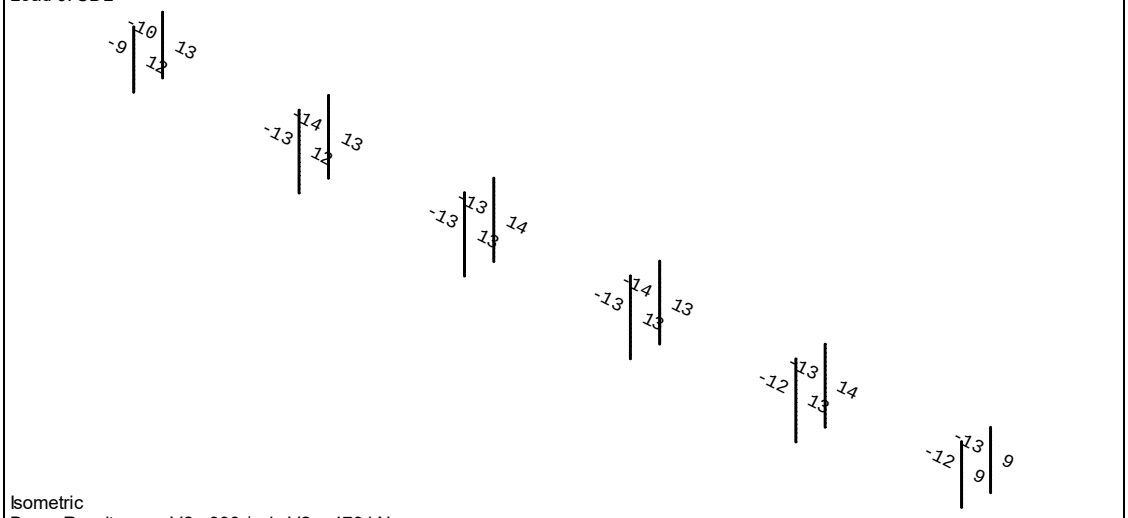

Load 6: UDL
-2
-1
2
2
-1
-1
2
2
-1
-1
1
1
-1
-1
1
1
-2
-2
1
1
-2
-2
2
1
Isometric
Beam Results: max M1= 120 / min M1= -120 kNm

Load 6: UDL



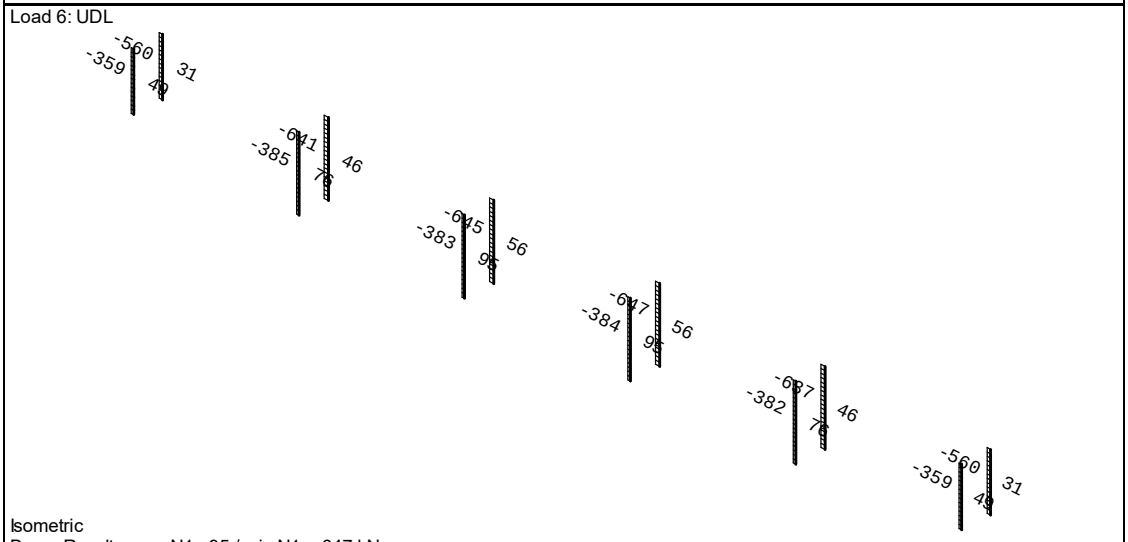
Isometric
Beam Results: max V3= 13 / min V3= -22 kN

Load 6: UDL

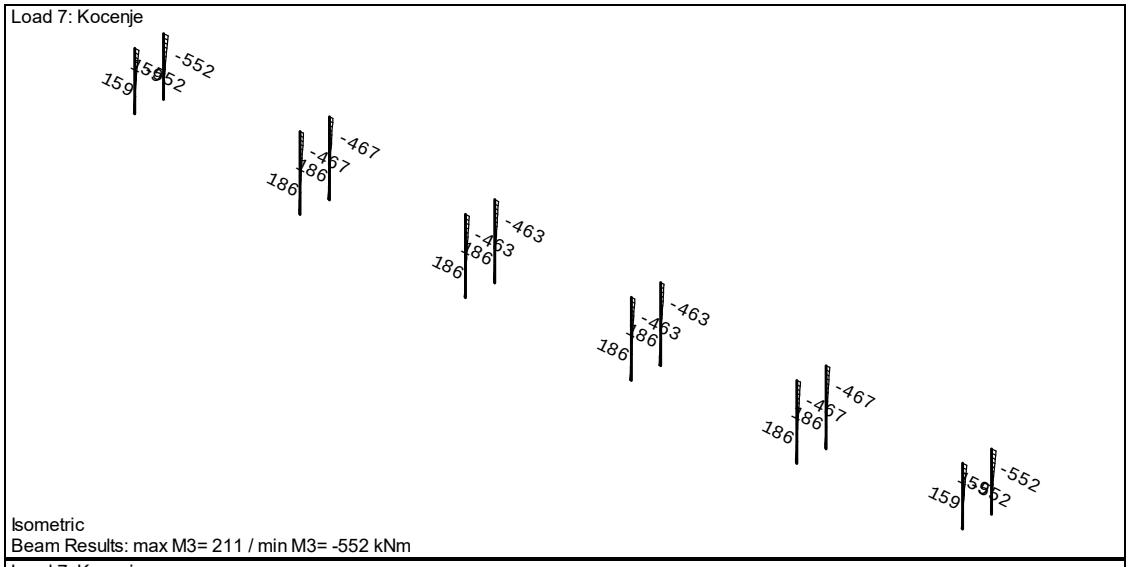


Isometric
Beam Results: max V2= 398 / min V2= -479 kN

Load 6: UDL



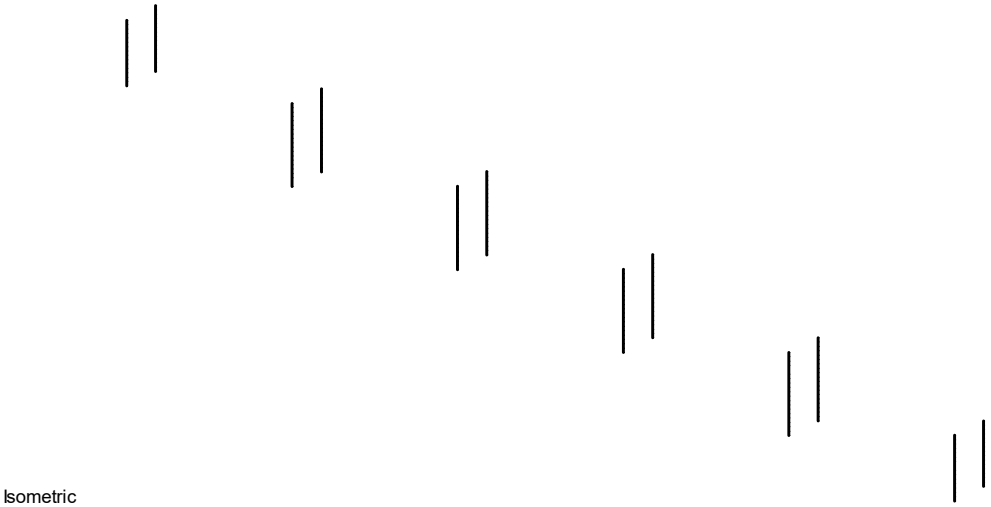
Isometric
Beam Results: max N1= 95 / min N1= -647 kN


Load 7: Kocenje
-552
159
-467
186
-463
186
-463
186
-467
186
-552
159
Isometric
Beam Results: max M3= 211 / min M3= -552 kNm

Load 7: Kocenje
1
-1
-1
1
Isometric
Beam Results: max M2= 98 / min M2= -16 kNm

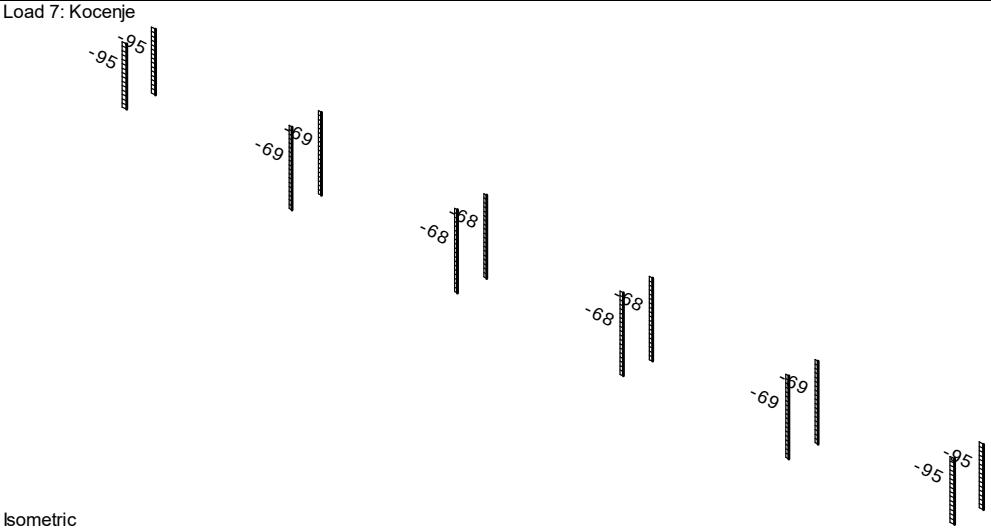
Load 7: Kocenje
-2
2
-1
1
-1
1
-1
1
-1
1
-2
2
Isometric
Beam Results: max M1= 382 / min M1= -382 kNm

Load 7: Kocenje



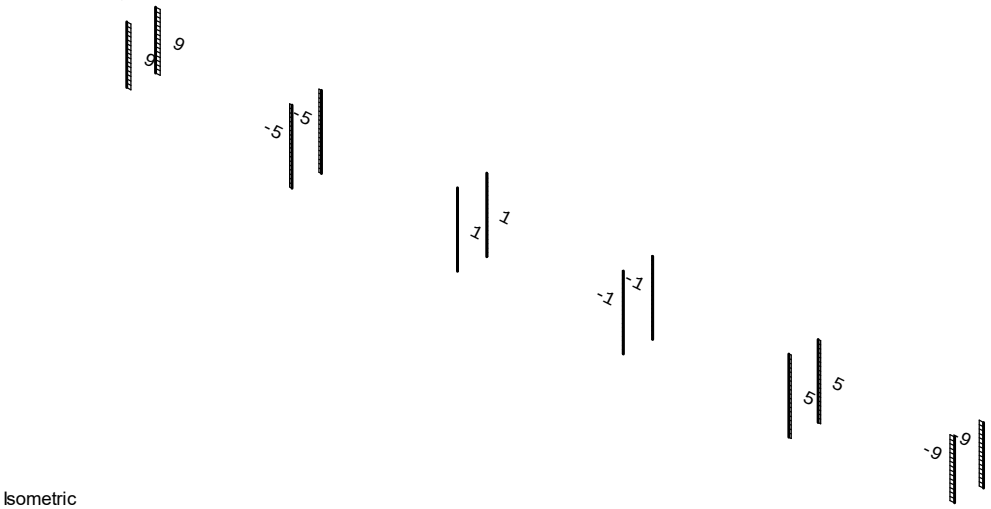
Isometric
Beam Results: max V3= 70 / min V3= -69 kN

Load 7: Kocenje

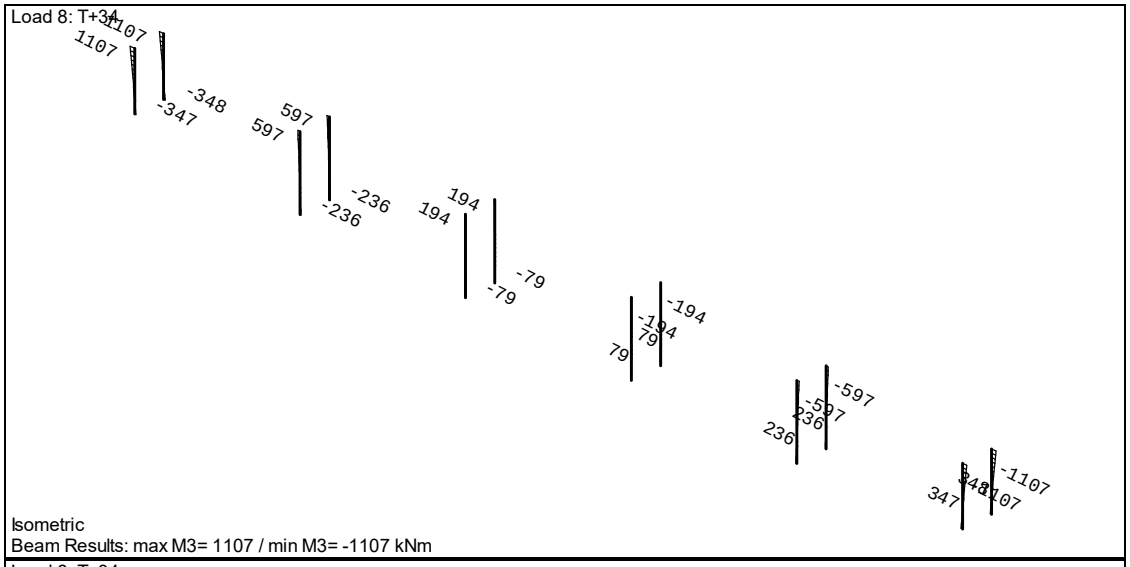


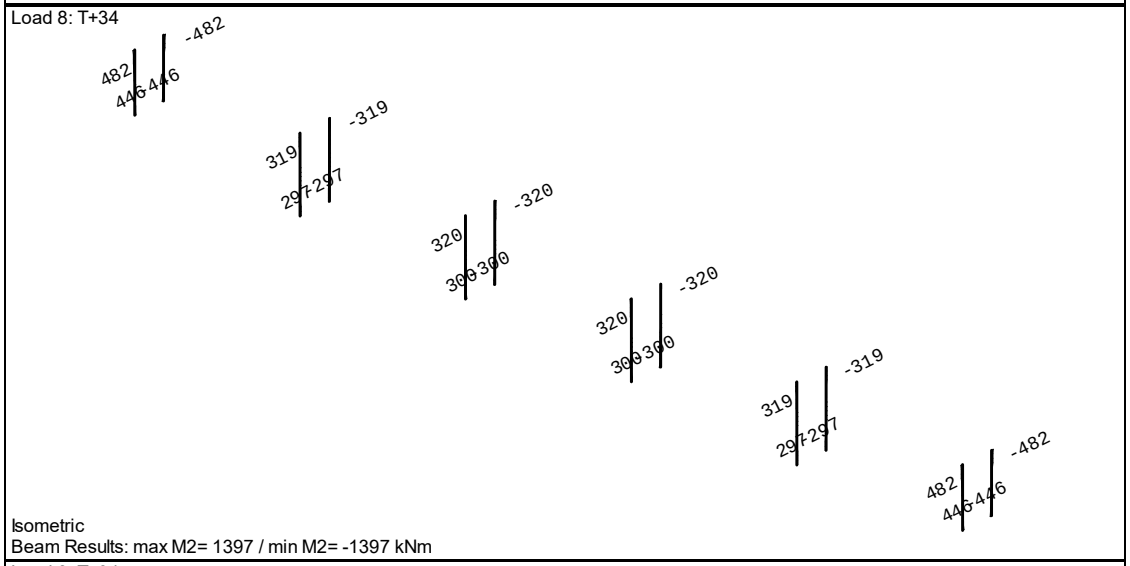
Isometric
Beam Results: max V2= 29 / min V2= -95 kN

Load 7: Kocenje

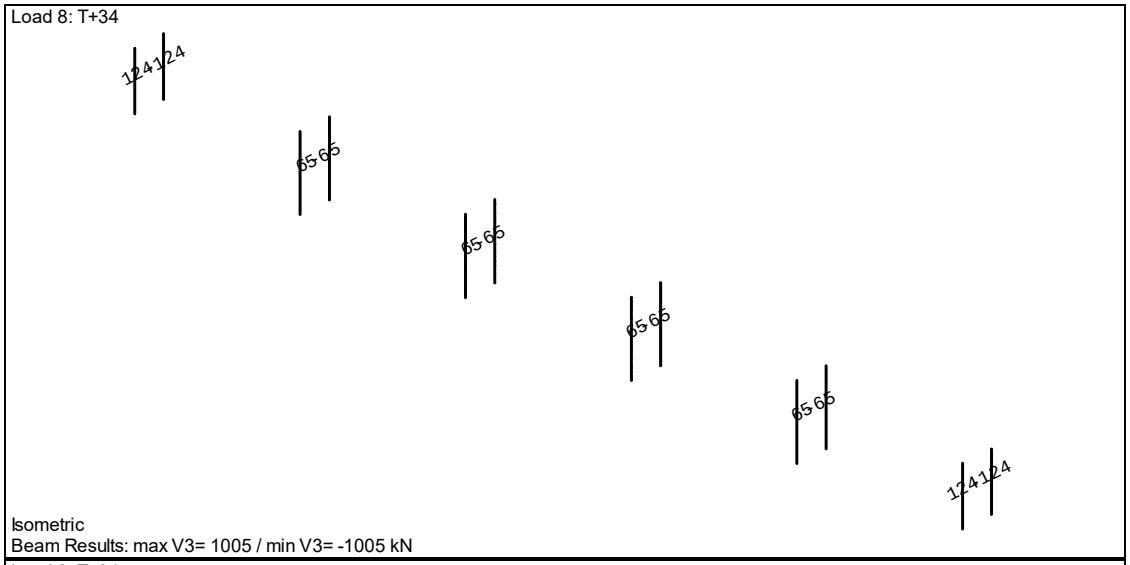


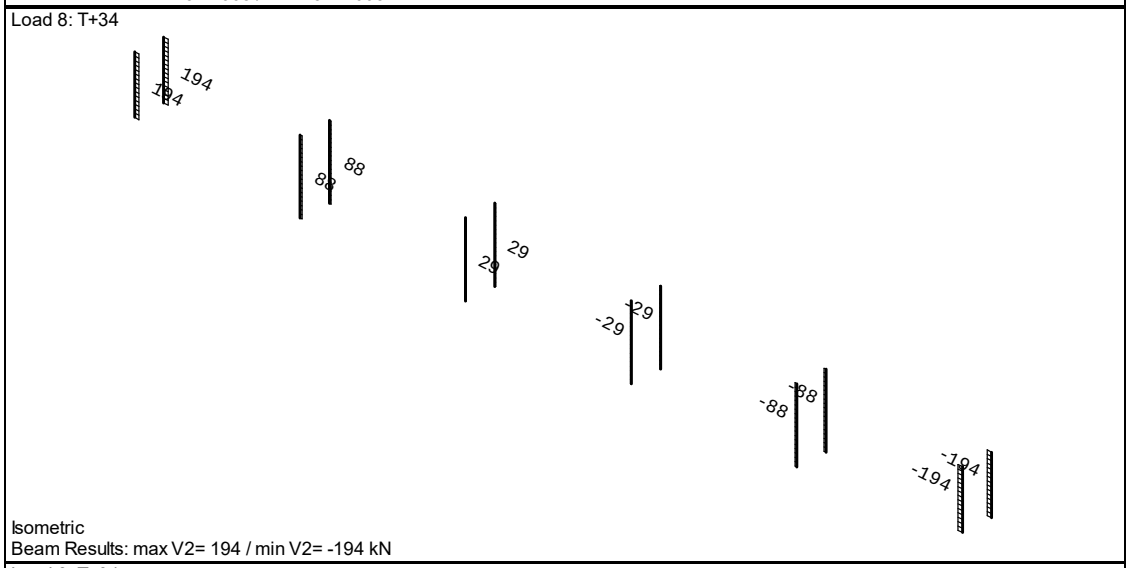
Isometric
Beam Results: max N1= 9 / min N1= -9 kN

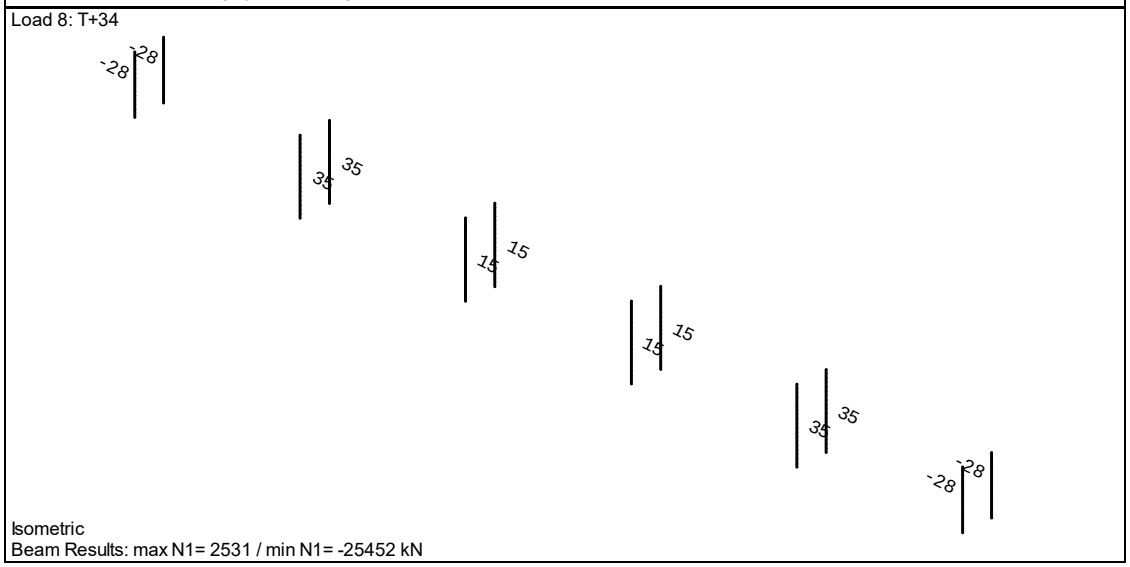

Load 8: T+34
1107
1107
-1107
-348
-347
597
597
-236
-236
194
194
-79
-79
-194
-194
79
79
-597
-597
236
236
-1107
-1107
347
347
Isometric
Beam Results: max M3= 1107 / min M3= -1107 kNm

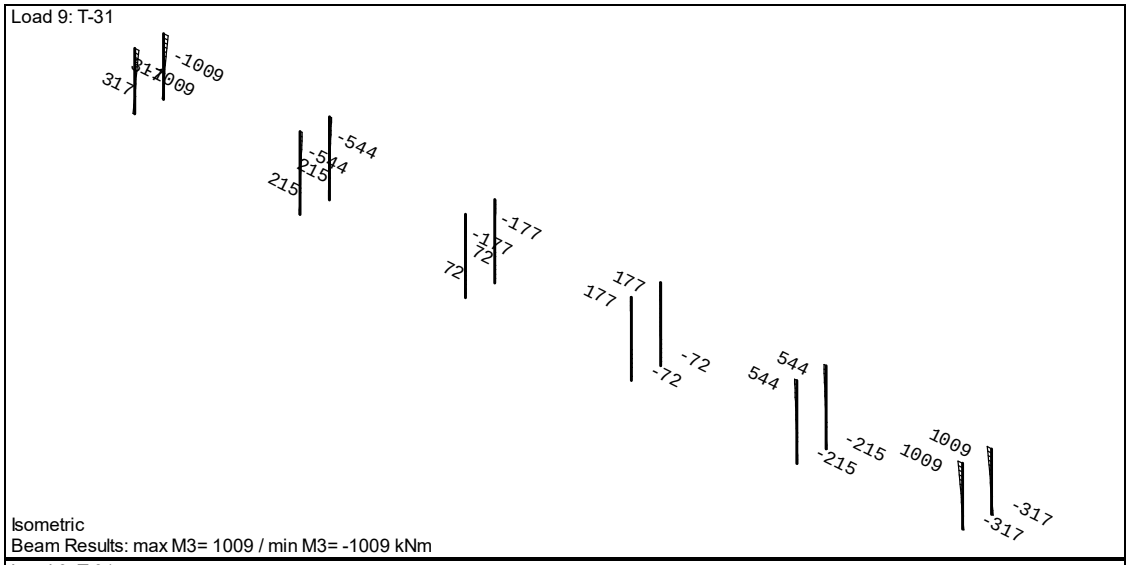

Load 8: T+34
-482
482
446
446
-319
319
297
297
-320
320
300
300
-320
320
300
300
-319
319
297
297
-482
482
446
446
Isometric
Beam Results: max M2= 1397 / min M2= -1397 kNm

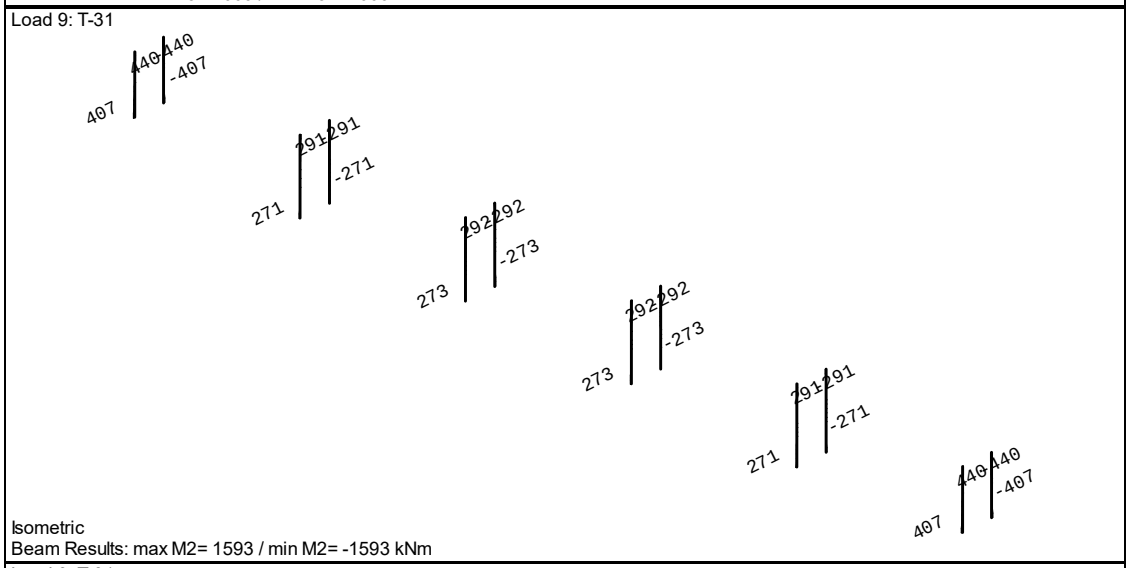
Load 8: T+34
-3
3
-1
1
-1
1
-3
3
Isometric
Beam Results: max M1= 766 / min M1= -766 kNm


Load 8: T+34
124
124
124
124
65
65
65
65
65
65
124
124
124
124
Isometric
Beam Results: max V3= 1005 / min V3= -1005 kN

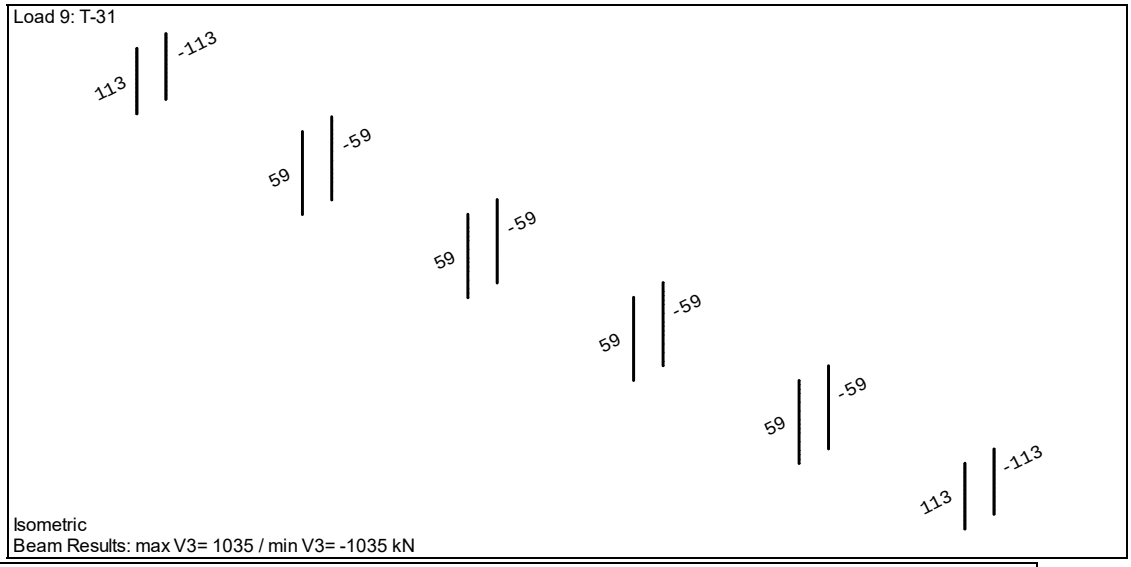

Load 8: T+34
194
194
88
88
88
88
29
29
29
29
-29
-29
-88
-88
-88
-88
-194
-194
-194
-194
Isometric
Beam Results: max V2= 194 / min V2= -194 kN

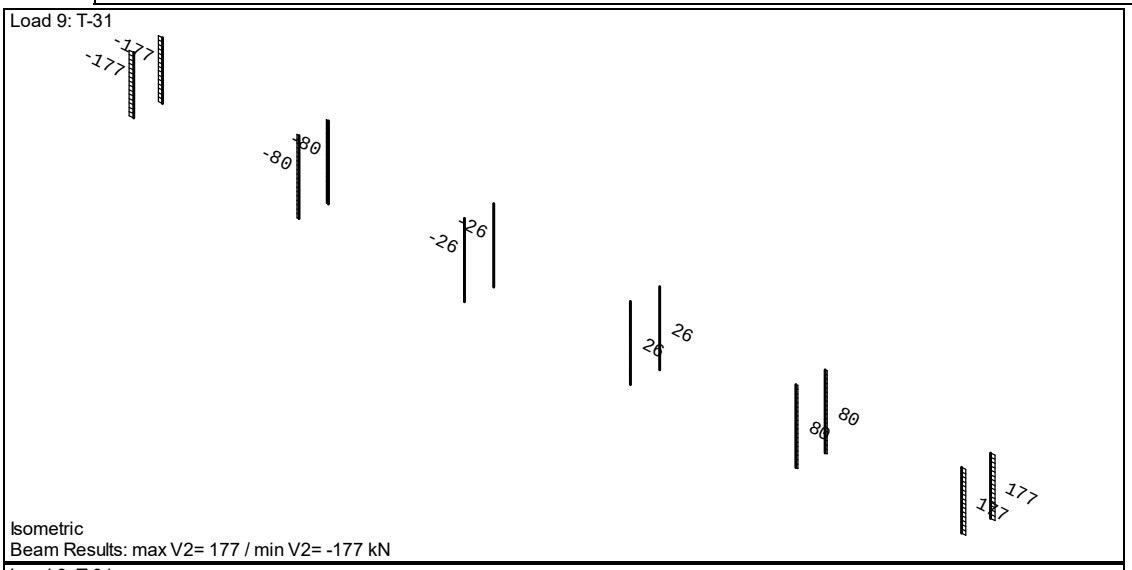

Load 8: T+34
-28
-28
-28
-28
35
35
35
35
15
15
15
15
15
15
35
35
35
35
-28
-28
-28
-28
Isometric
Beam Results: max N1= 2531 / min N1= -25452 kN

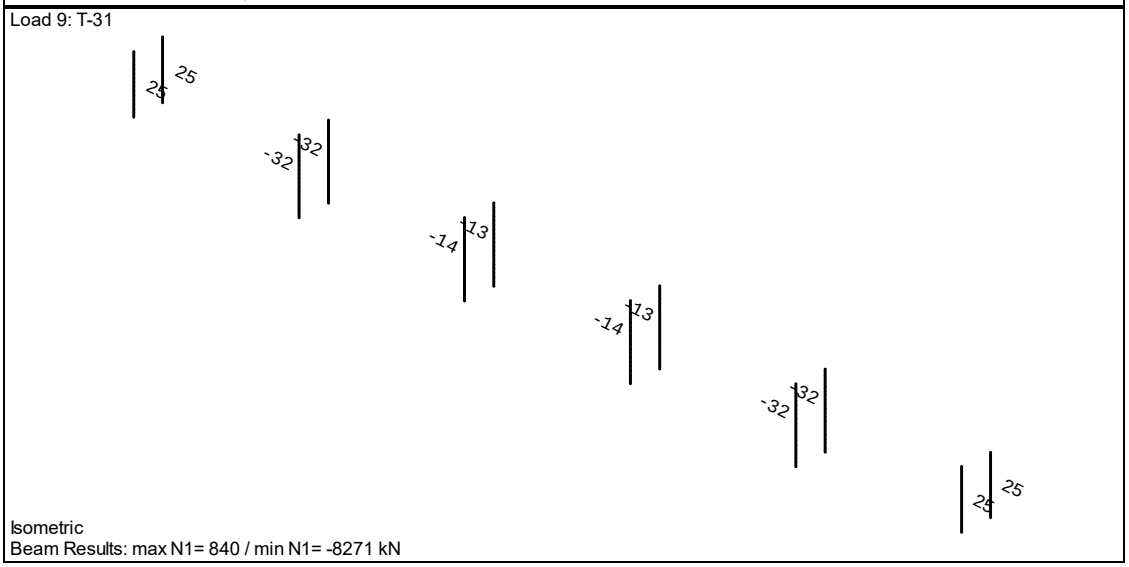

Load 9: T-31
317
-317
-1009
1009
215
-215
-544
544
72
-72
-177
177
544
-215
1009
-317
Isometric
Beam Results: max M3= 1009 / min M3= -1009 kNm

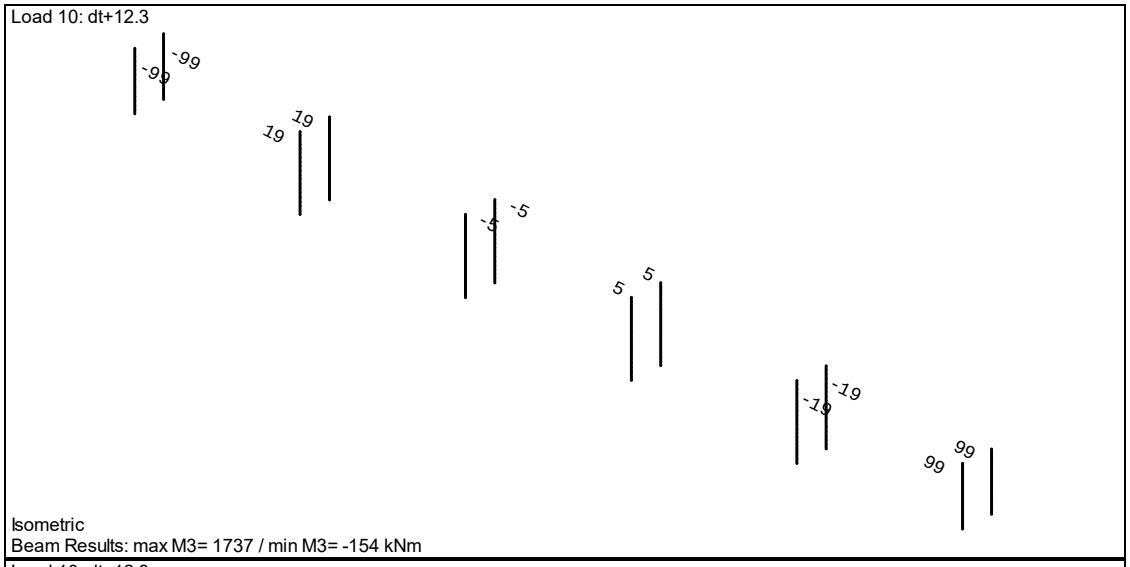

Load 9: T-31
407
-407
440
271
-271
291
273
-273
292
Isometric
Beam Results: max M2= 1593 / min M2= -1593 kNm

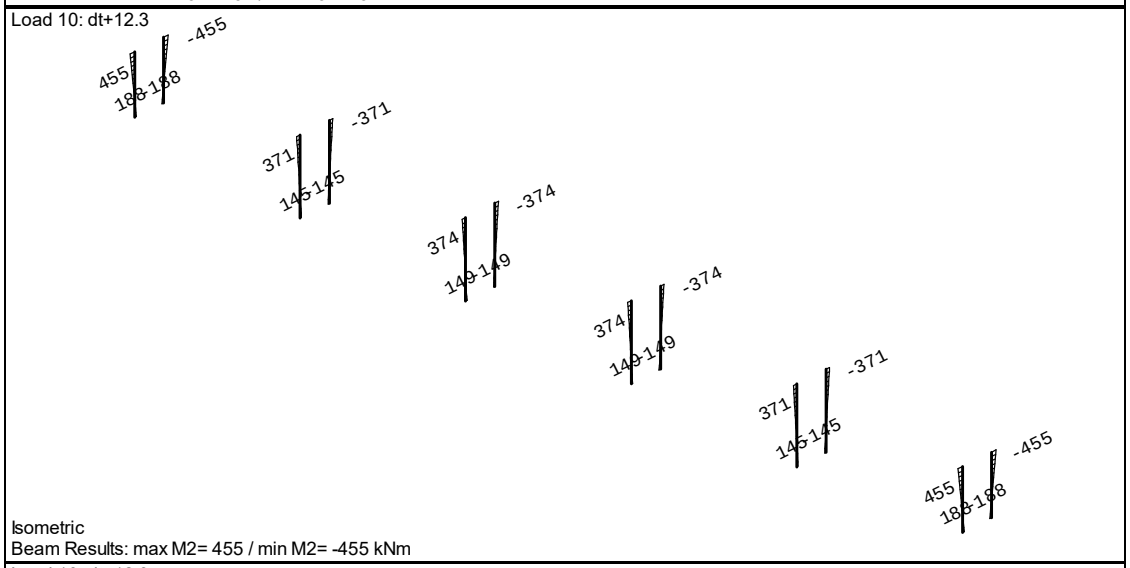
Load 9: T-31
-3
3
-1
1
Isometric
Beam Results: max M1= 699 / min M1= -699 kNm


Load 9: T-31
113
-113
59
-59
59
-59
59
-59
59
-59
113
-113
Isometric
Beam Results: max V3= 1035 / min V3= -1035 kN


Load 9: T-31
-177
177
-80
80
-26
26
26
26
80
80
177
177
Isometric
Beam Results: max V2= 177 / min V2= -177 kN

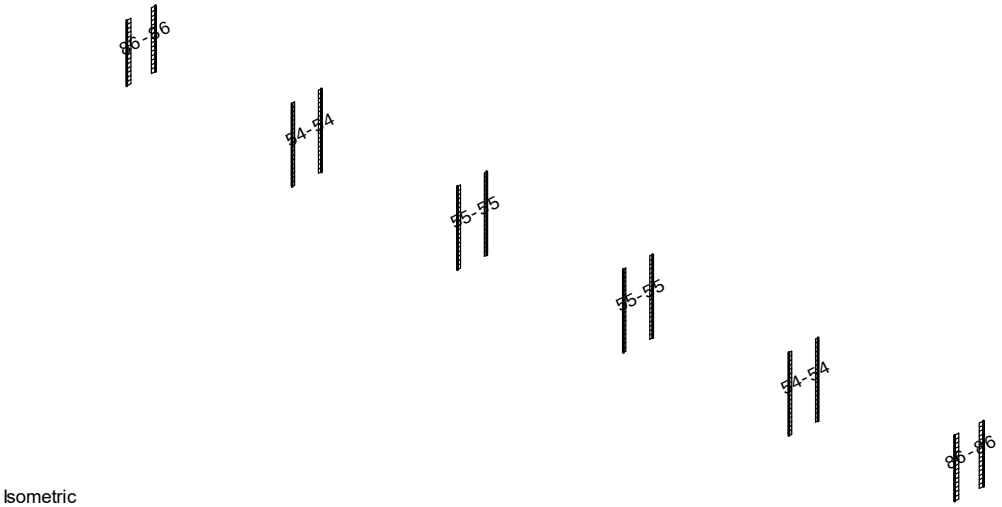

Load 9: T-31
25
25
-32
32
-14
13
-14
13
-32
32
25
25
Isometric
Beam Results: max N1= 840 / min N1= -8271 kN


Load 10: dt+12.3
Isometric
Beam Results: max M3= 1737 / min M3= -154 kNm


Load 10: dt+12.3
-455
455
-188
188
-371
371
-145
145
-374
374
-149
149
-374
374
-149
149
-371
371
-145
145
-455
455
-188
188
Isometric
Beam Results: max M2= 455 / min M2= -455 kNm

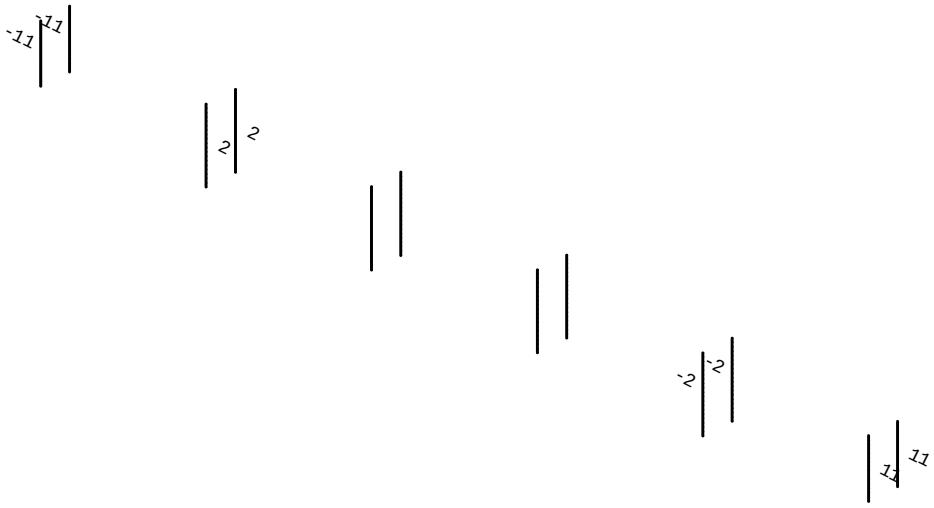
Load 10: dt+12.3
Isometric
Beam Results: max M1= 211 / min M1= -211 kNm

Load 10: dt+12.3



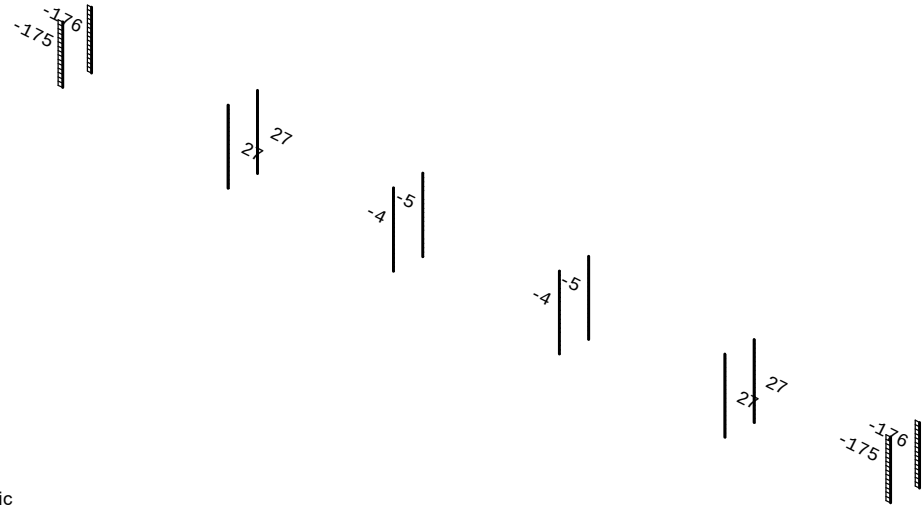
Isometric
Beam Results: max V3= 86 / min V3= -86 kN

Load 10: dt+12.3

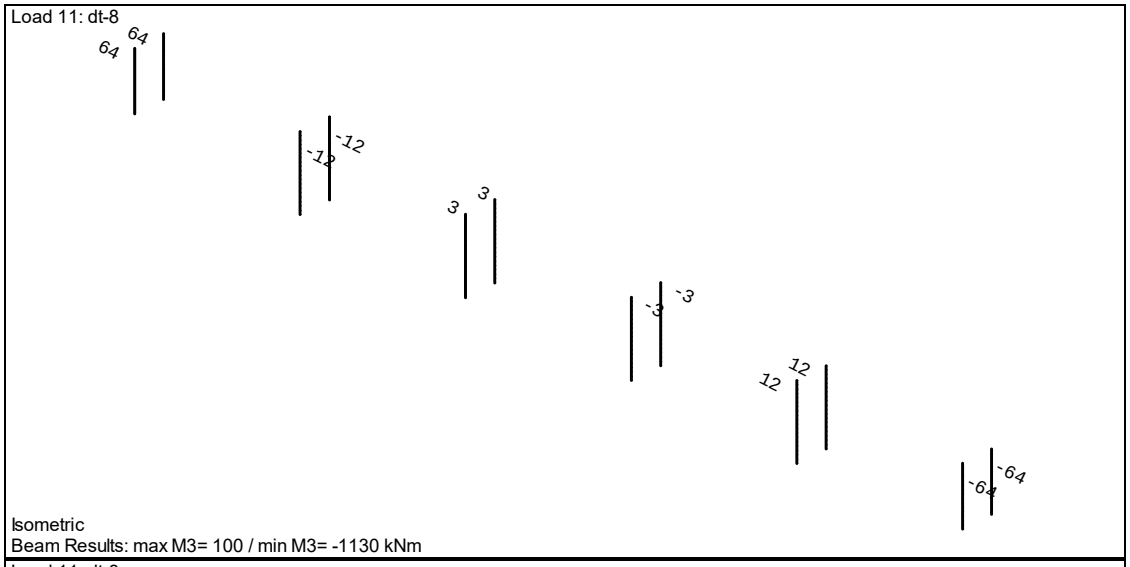


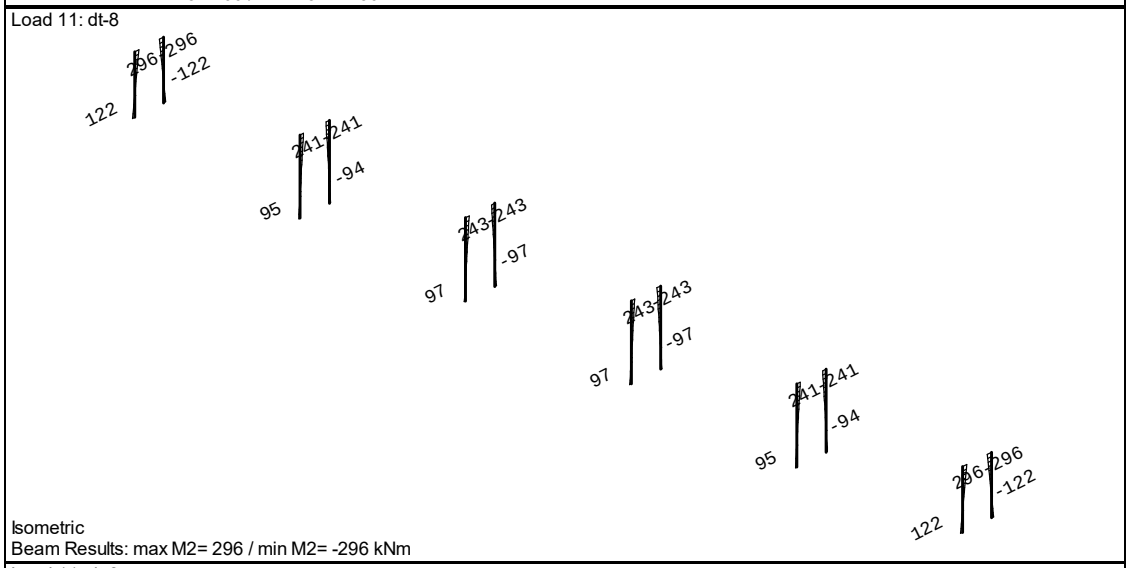
Isometric
Beam Results: max V2= 325 / min V2= -307 kN

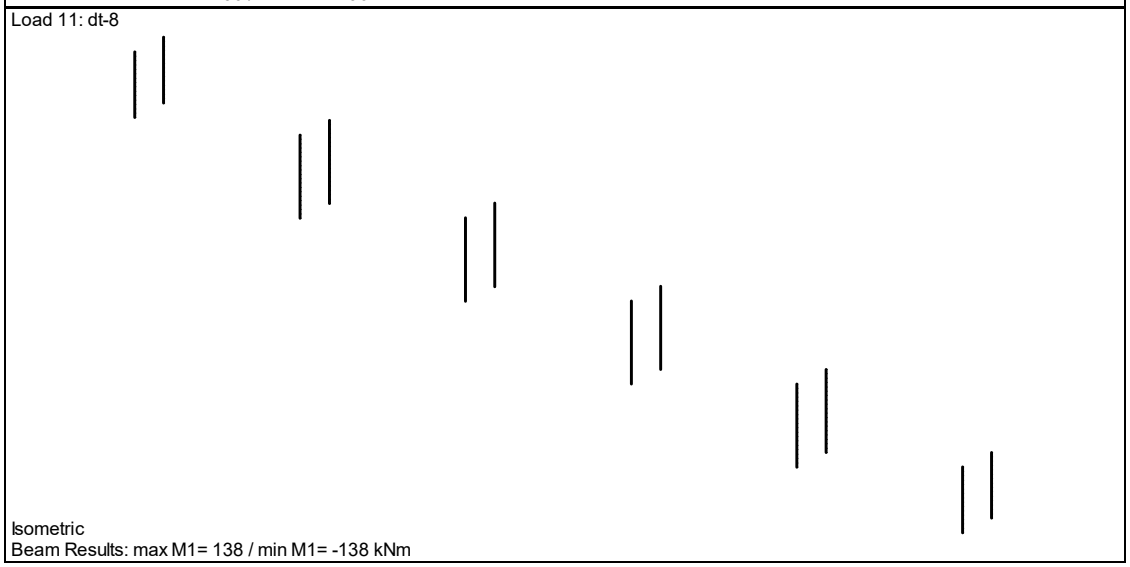
Load 10: dt+12.3

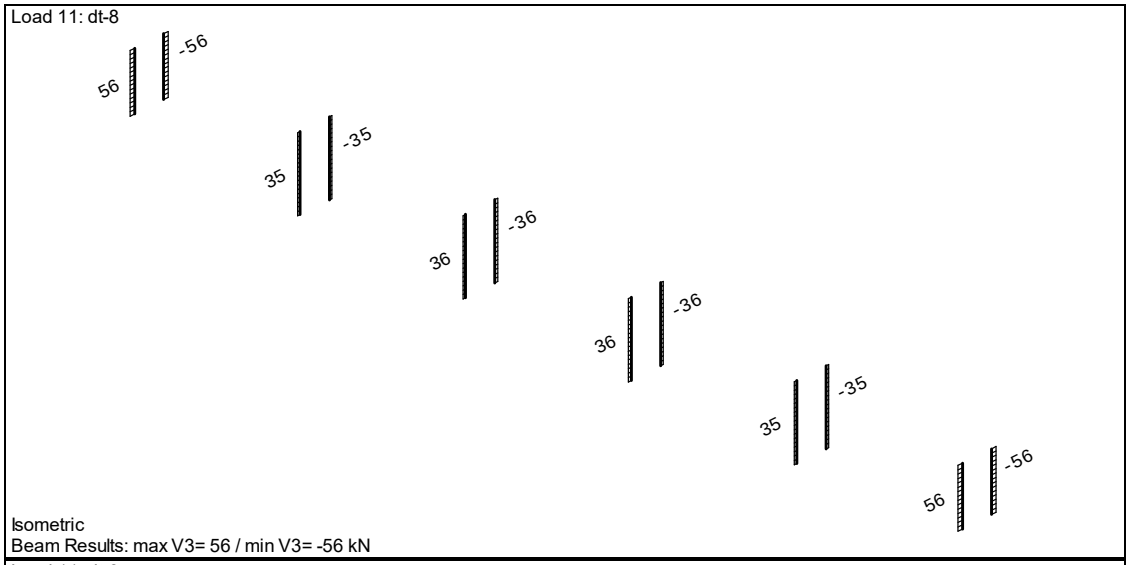


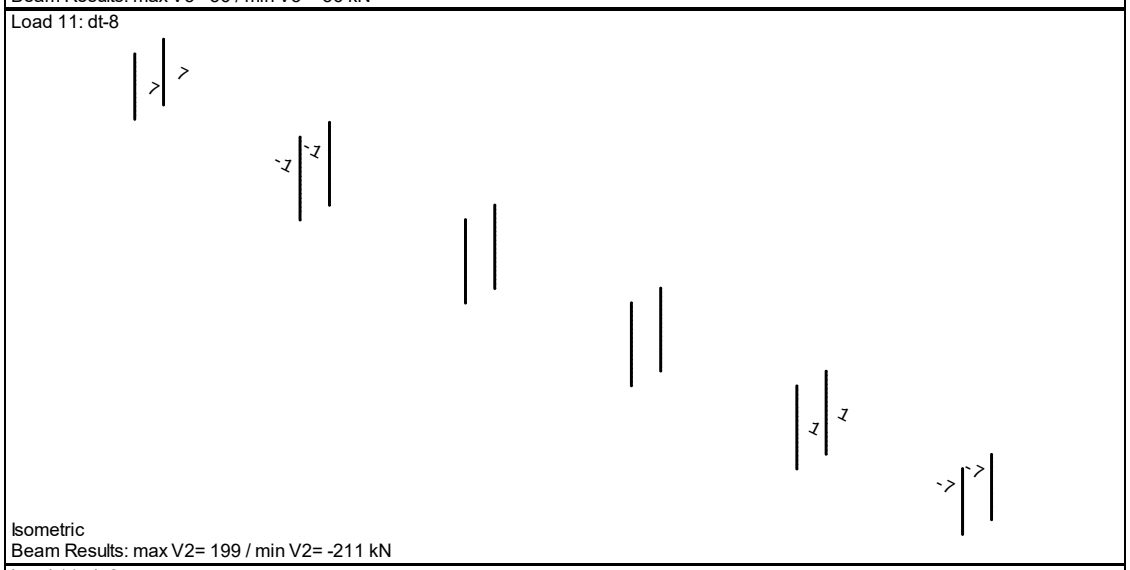
Isometric
Beam Results: max N1= 86 / min N1= -176 kN

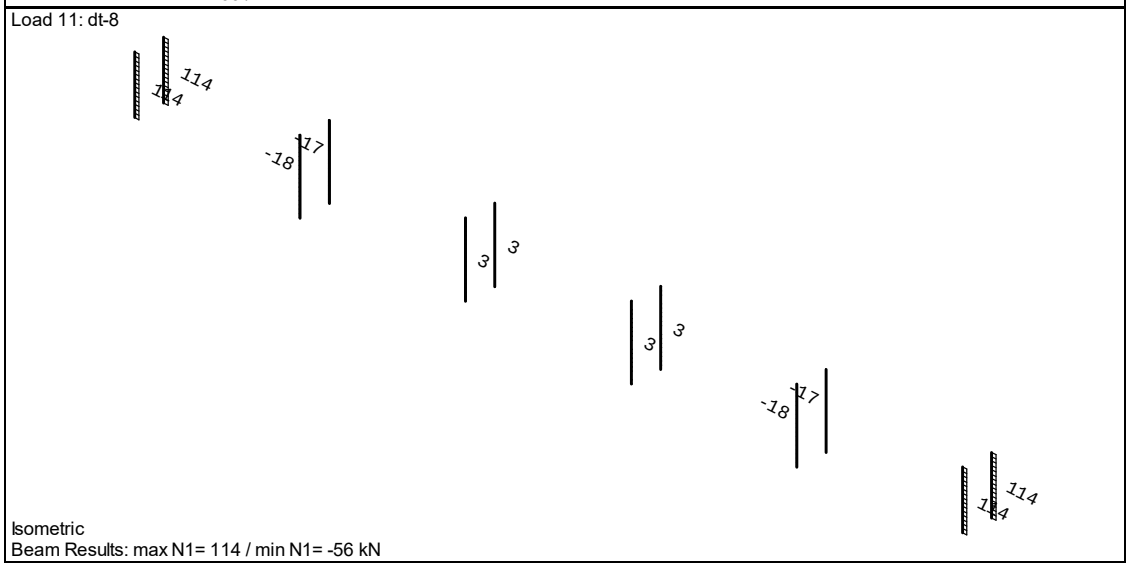

Load 11: dt-8
64
64
-12
-12
3
3
-3
-3
12
12
-64
-64
Isometric
Beam Results: max M3= 100 / min M3= -1130 kNm

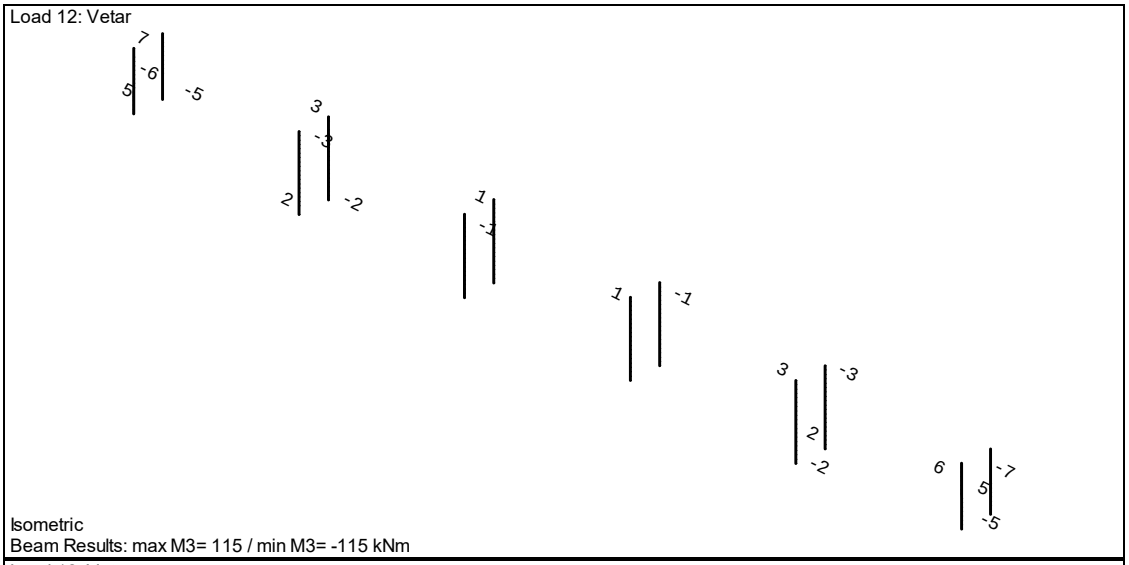

Load 11: dt-8
296
296
-122
122
241
241
-94
95
243
243
-97
97
243
243
-97
97
241
241
-94
95
296
296
-122
122
Isometric
Beam Results: max M2= 296 / min M2= -296 kNm

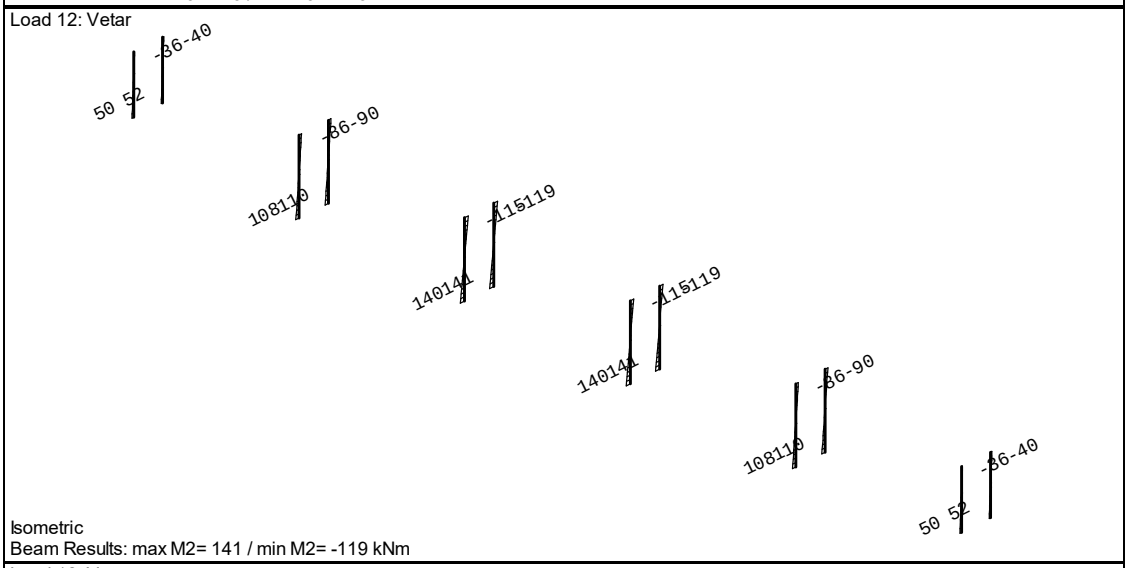

Load 11: dt-8
Isometric
Beam Results: max M1= 138 / min M1= -138 kNm

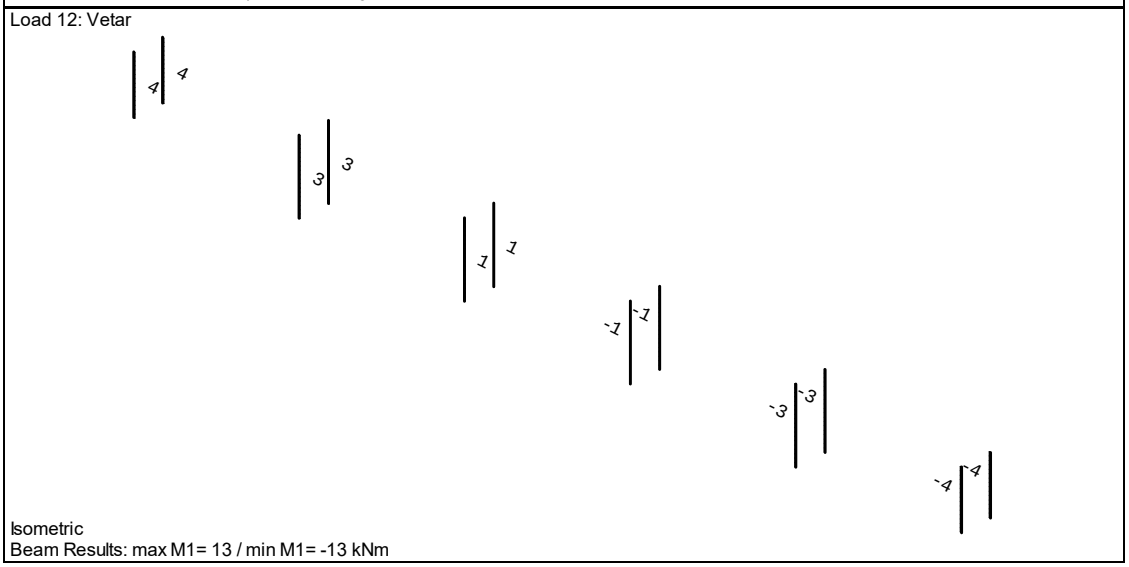

Load 11: dt-8
56
-56
35
-35
36
-36
36
-36
35
-35
56
-56
Isometric
Beam Results: max V3= 56 / min V3= -56 kN


Load 11: dt-8
Isometric
Beam Results: max V2= 199 / min V2= -211 kN

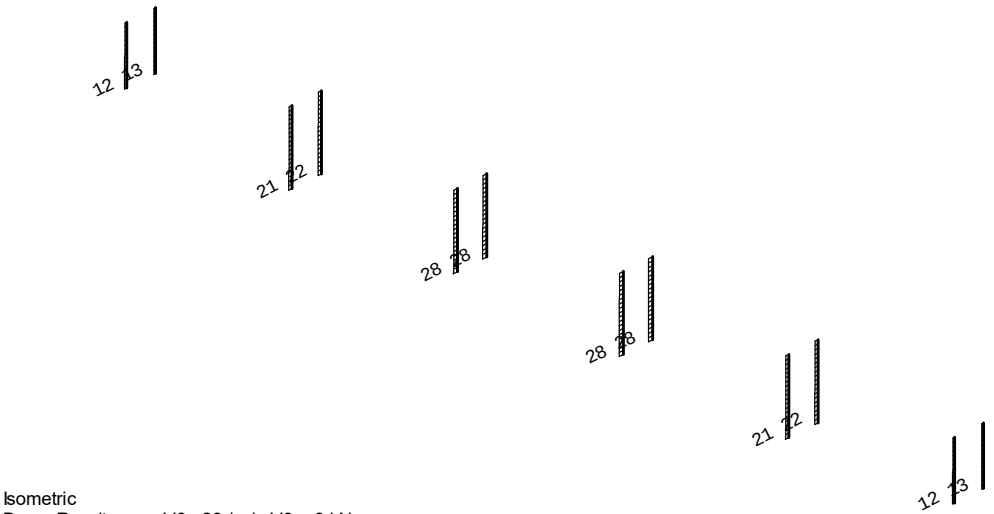

Load 11: dt-8
Isometric
Beam Results: max N1= 114 / min N1= -56 kN


Load 12: Vetar
Isometric
Beam Results: max M3= 115 / min M3= -115 kNm


Load 12: Vetar
-86-40
50 52
-86-90
108110
-115119
140141
-115119
140141
-86-90
108110
-86-40
50 52
Isometric
Beam Results: max M2= 141 / min M2= -119 kNm

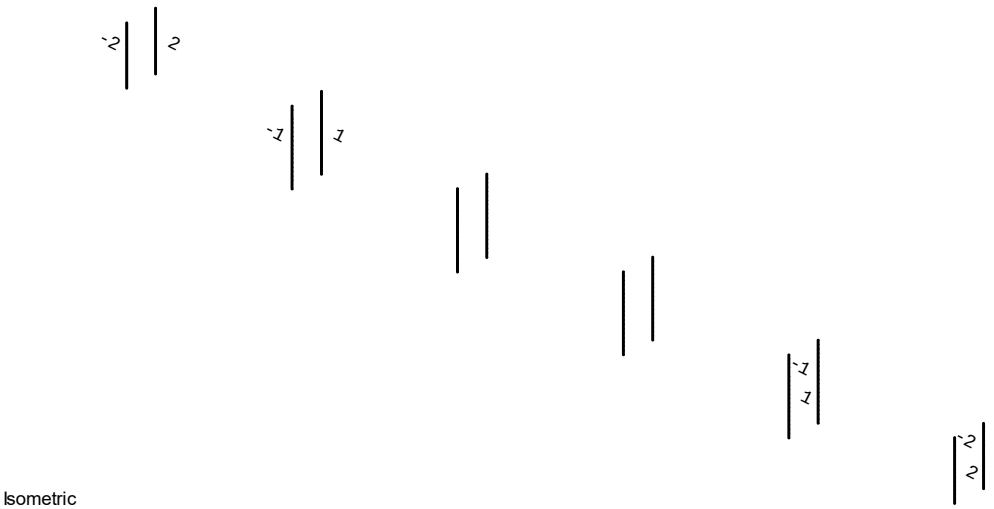

Load 12: Vetar
Isometric
Beam Results: max M1= 13 / min M1= -13 kNm

Load 12: Vetar



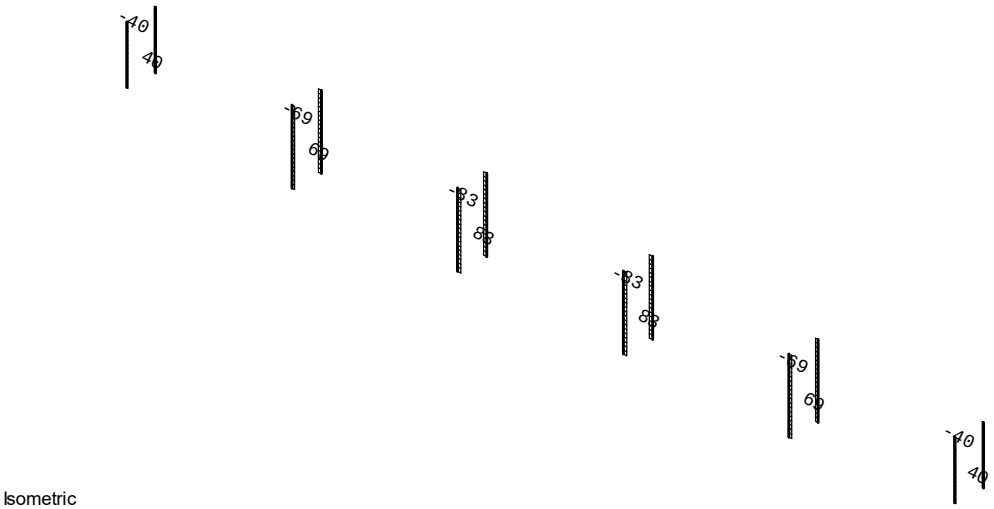
Isometric
Beam Results: max V3= 29 / min V3= -3 kN

Load 12: Vetar

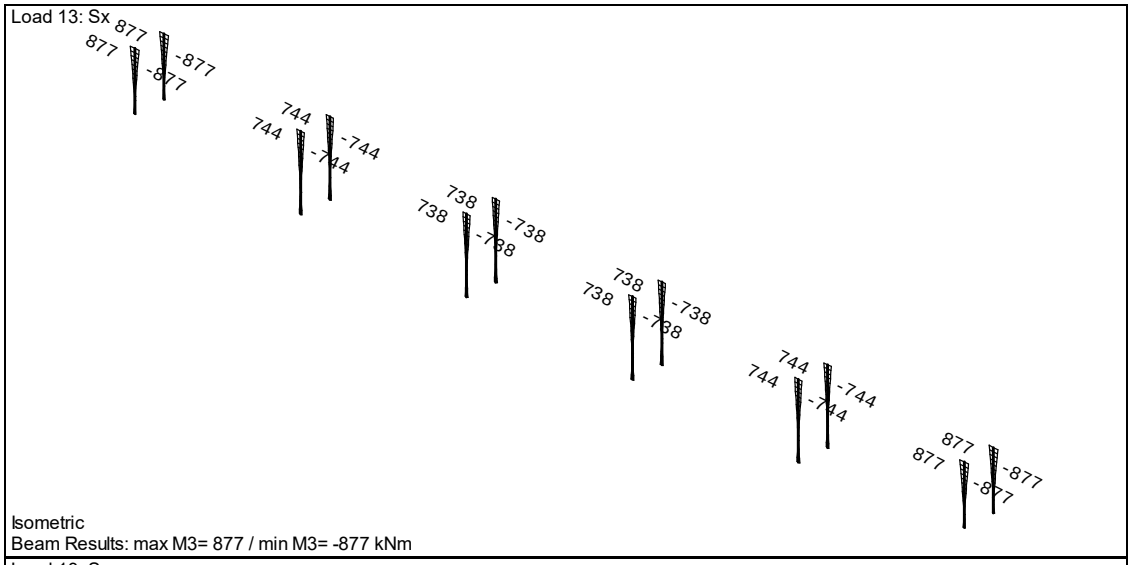


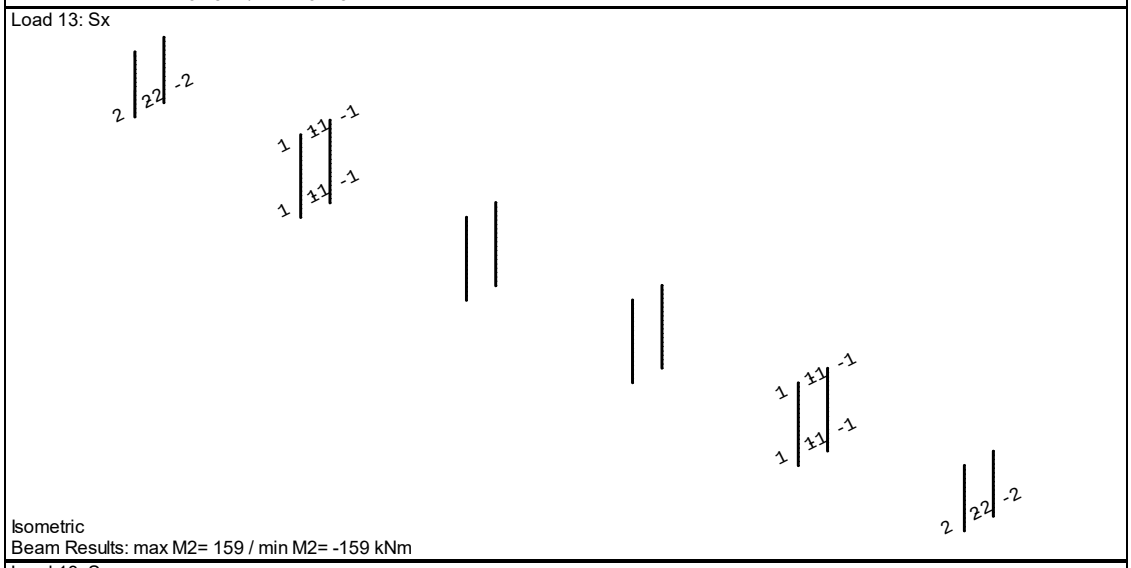
Isometric
Beam Results: max V2= 107 / min V2= -46 kN

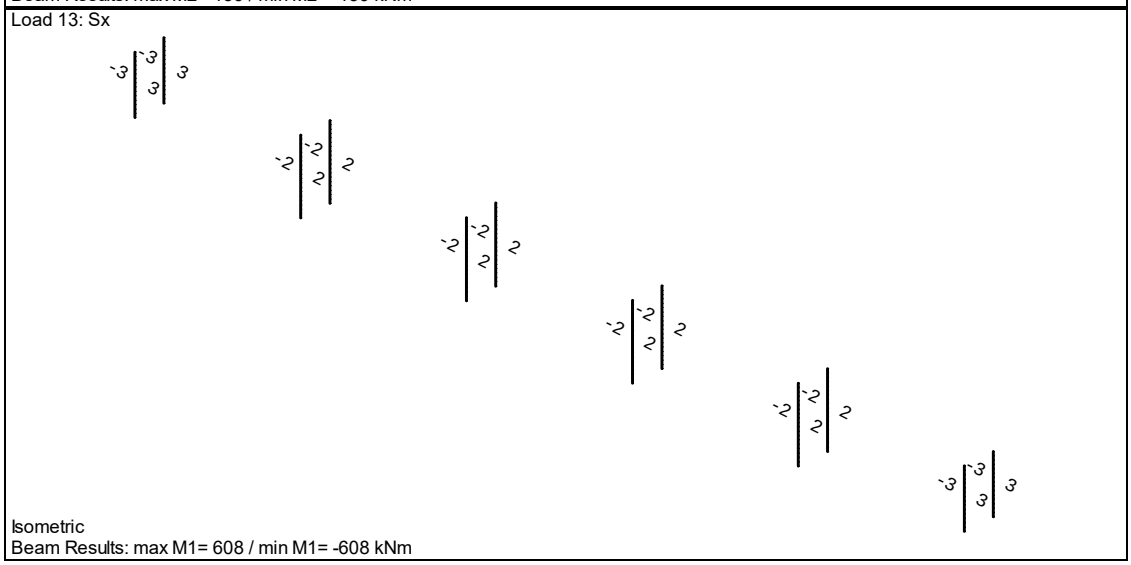
Load 12: Vetar

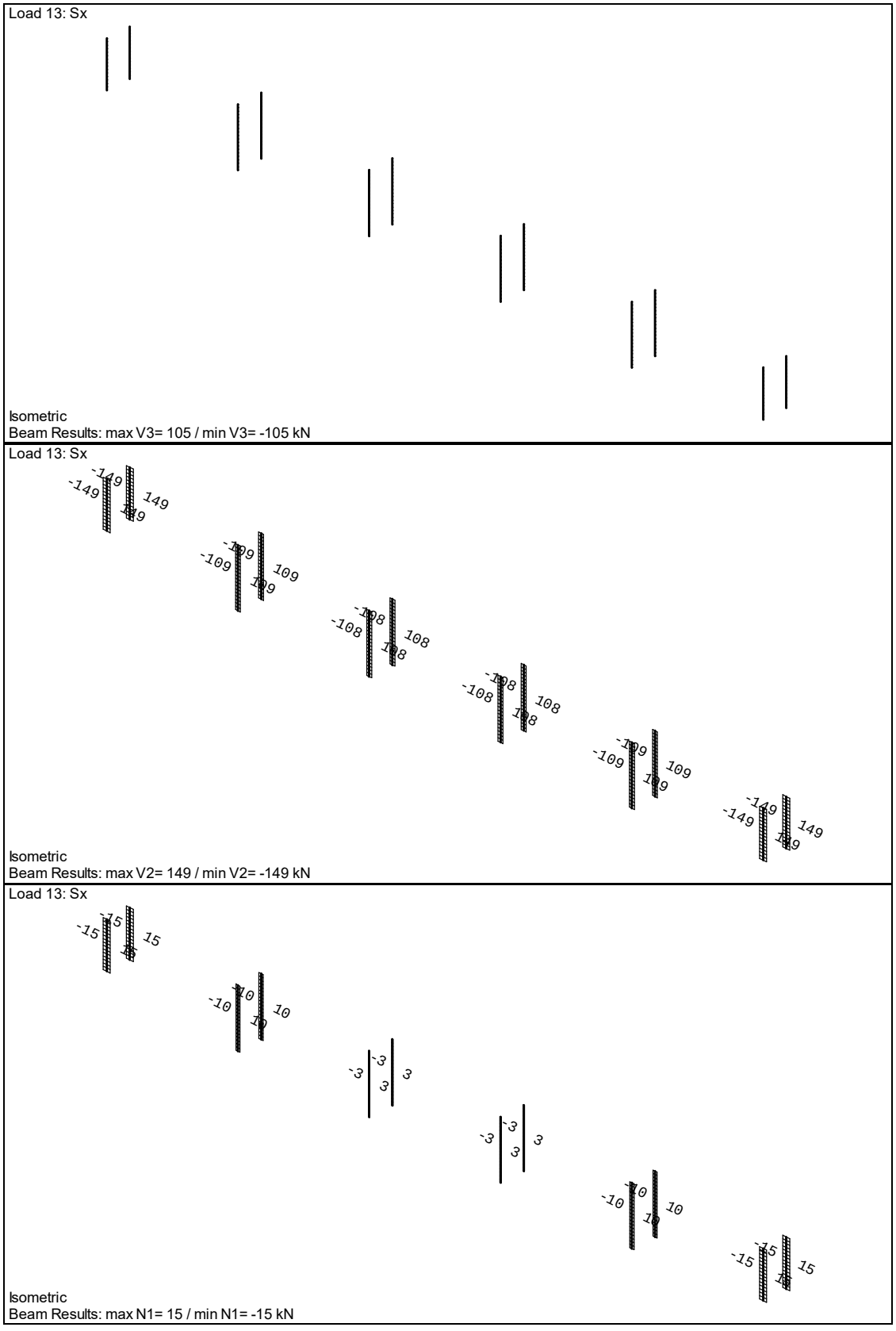


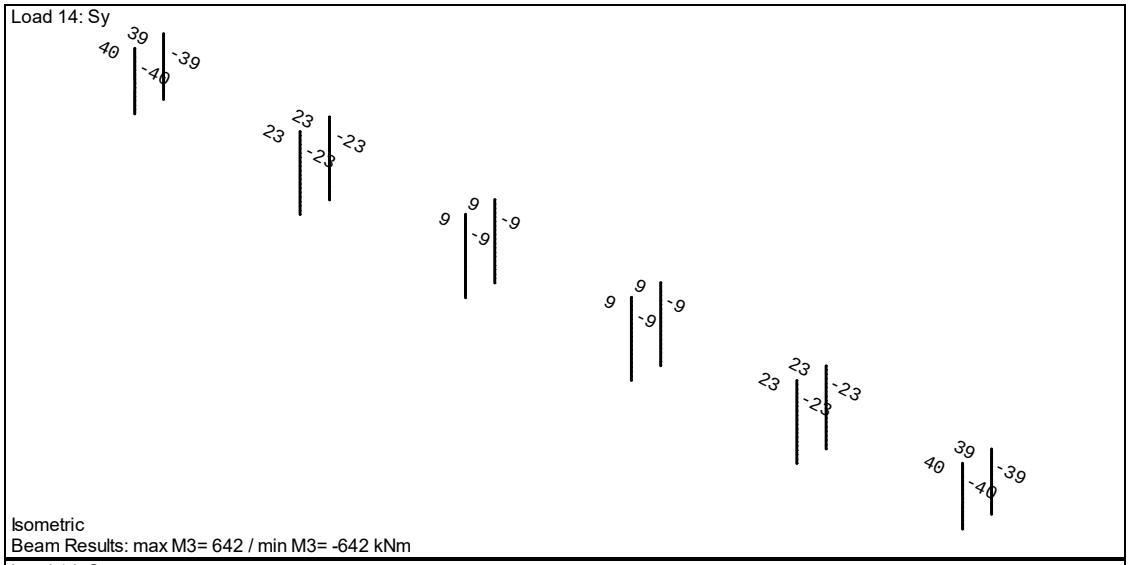
Isometric
Beam Results: max N1= 107 / min N1= -107 kN

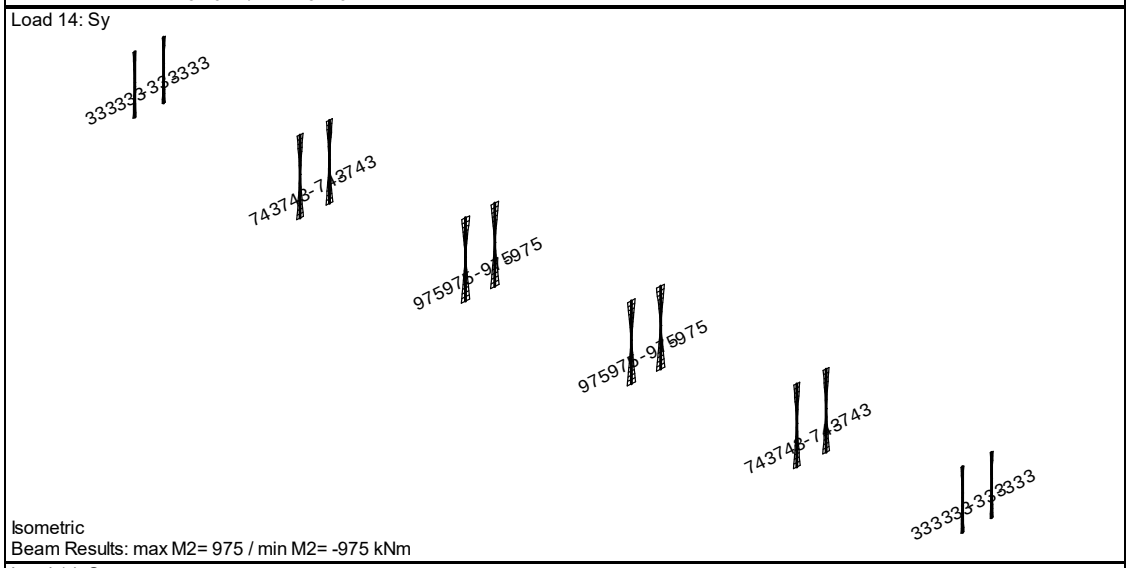

Load 13: Sx
877
877
-877
-877
744
744
-744
-744
738
738
-738
-738
738
738
-738
-738
744
744
-744
-744
877
877
-877
-877
Isometric
Beam Results: max M3= 877 / min M3= -877 kNm

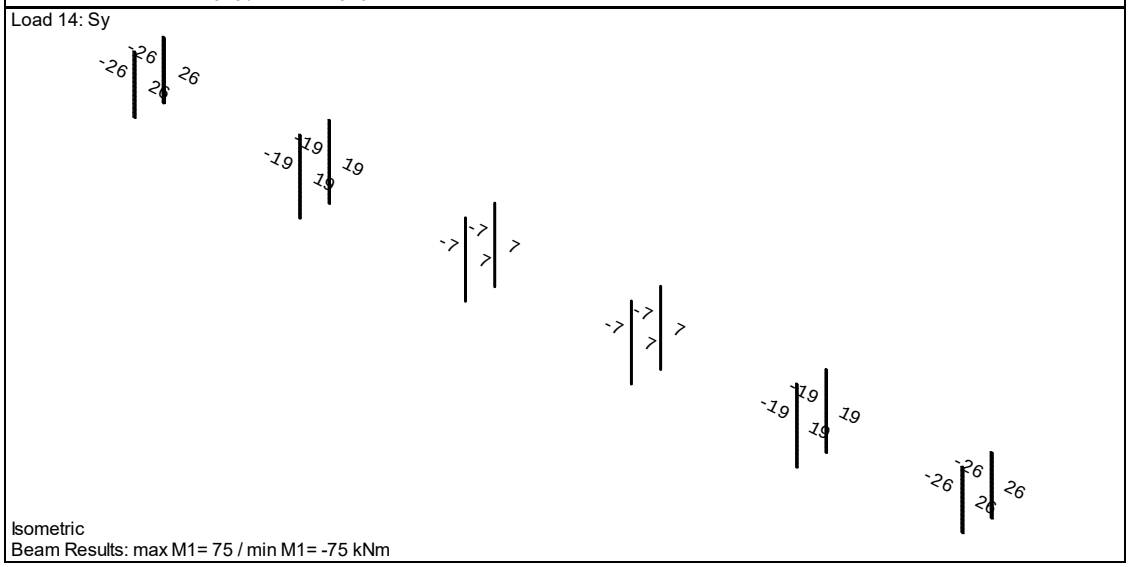

Load 13: Sx
2
2
-2
1
1
-1
1
1
-1
1
1
-1
2
2
-2
Isometric
Beam Results: max M2= 159 / min M2= -159 kNm

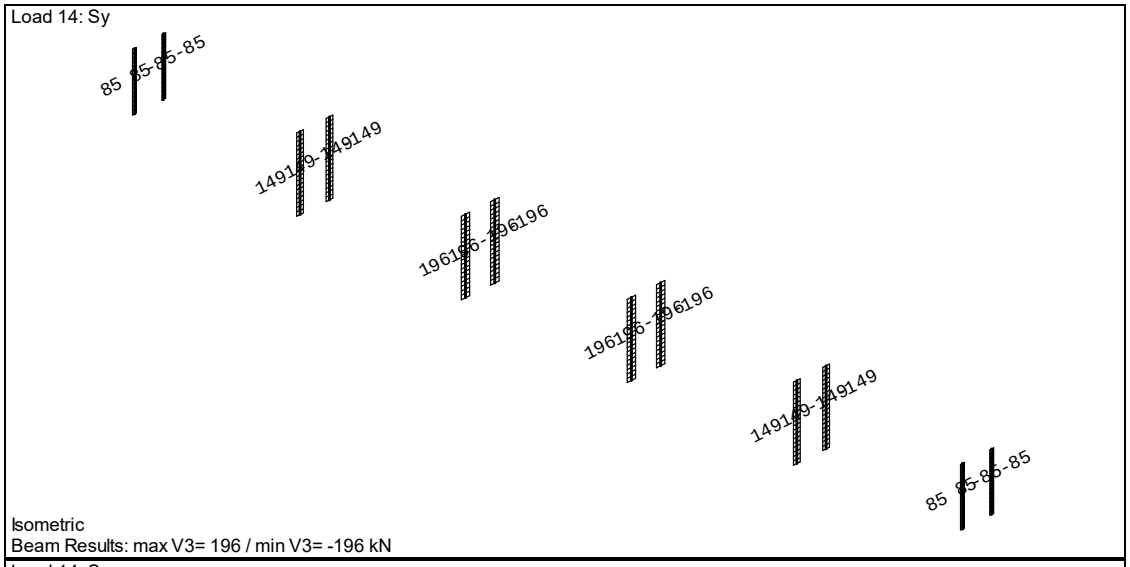

Load 13: Sx
-3
-3
3
3
-2
-2
2
2
-2
-2
2
2
-2
-2
2
2
-2
-2
2
2
-3
-3
3
3
Isometric
Beam Results: max M1= 608 / min M1= -608 kNm

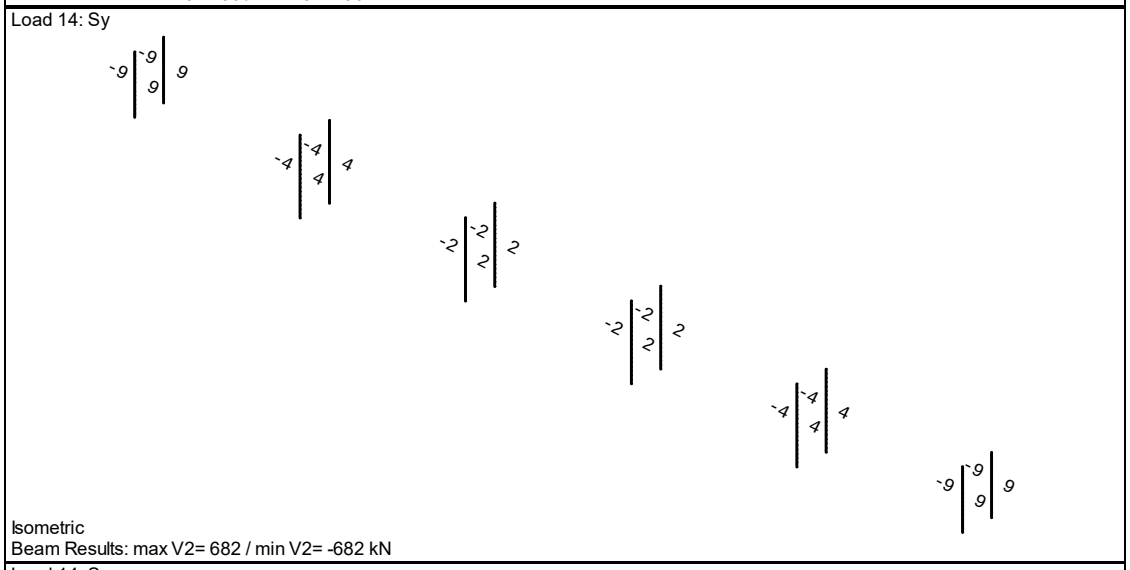

Load 13: Sx
Isometric
Beam Results: max V3= 105 / min V3= -105 kN
Load 13: Sx
Isometric
Beam Results: max V2= 149 / min V2= -149 kN
Load 13: Sx
Isometric
Beam Results: max N1= 15 / min N1= -15 kN

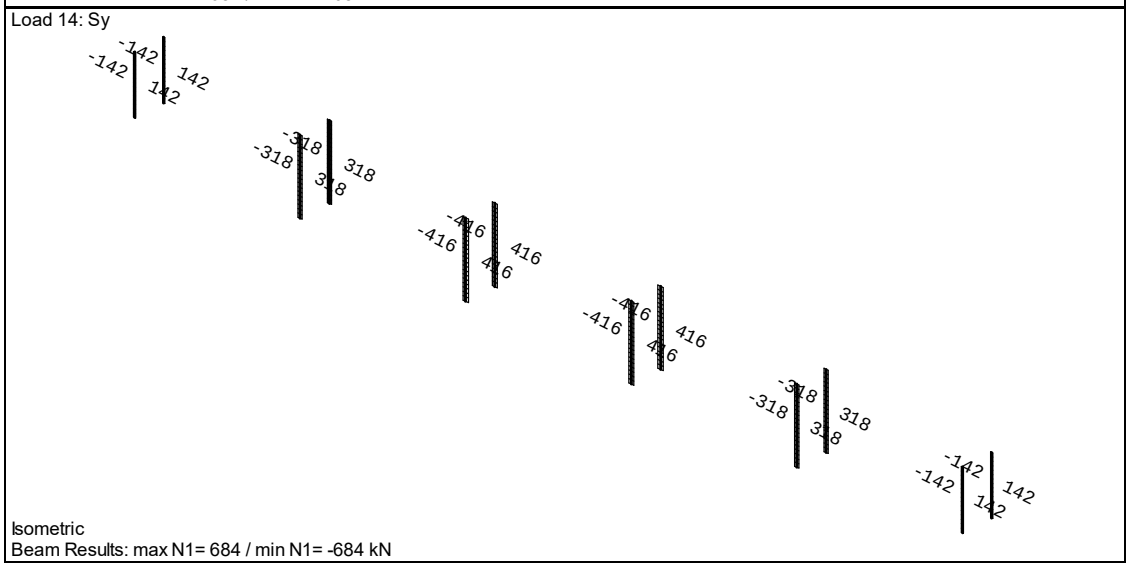

Load 14: Sy
Isometric
Beam Results: max M3= 642 / min M3= -642 kNm


Load 14: Sy
Isometric
Beam Results: max M2= 975 / min M2= -975 kNm

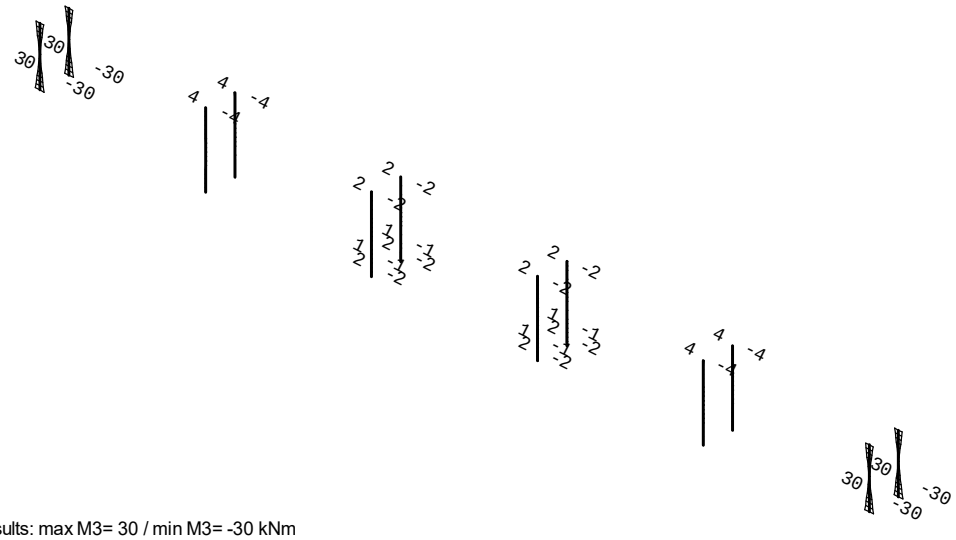

Load 14: Sy
Isometric
Beam Results: max M1= 75 / min M1= -75 kNm


Load 14: Sy
85
-85
-85
-85
149149
-149149
196196
-196196
196196
-196196
149149
-149149
85
-85
-85
-85
Isometric
Beam Results: max V3= 196 / min V3= -196 kN


Load 14: Sy
-9
-9
9
9
-4
-4
4
4
-2
-2
2
2
-2
-2
2
2
-4
-4
4
4
-9
-9
9
9
Isometric
Beam Results: max V2= 682 / min V2= -682 kN

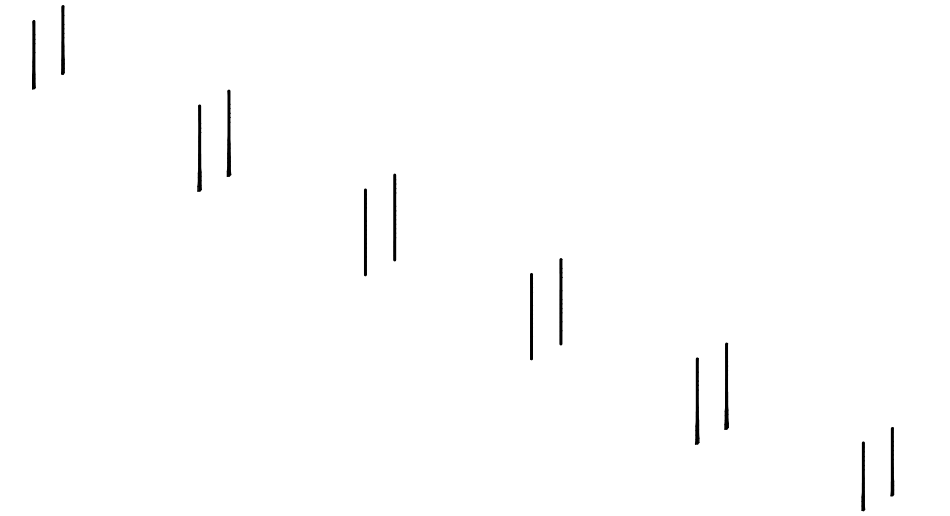

Load 14: Sy
-142
-142
142
142
-318
-318
318
318
-416
-416
416
416
-416
-416
416
416
-318
-318
318
318
-142
-142
142
142
Isometric
Beam Results: max N1= 684 / min N1= -684 kN

Load 15: Sz



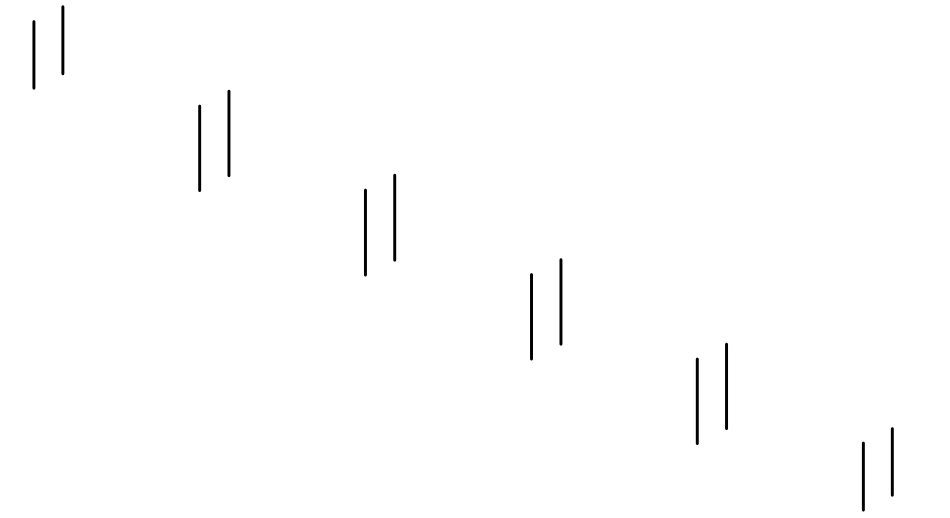
Isometric
Beam Results: max M3= 30 / min M3= -30 kNm

Load 15: Sz



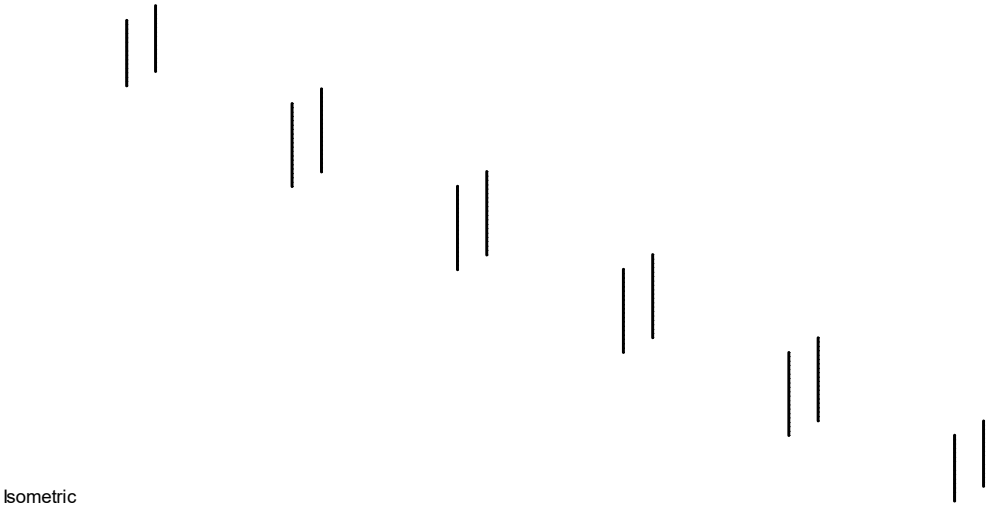
Isometric
Beam Results: max M2= 1 / min M2= -1 kNm

Load 15: Sz



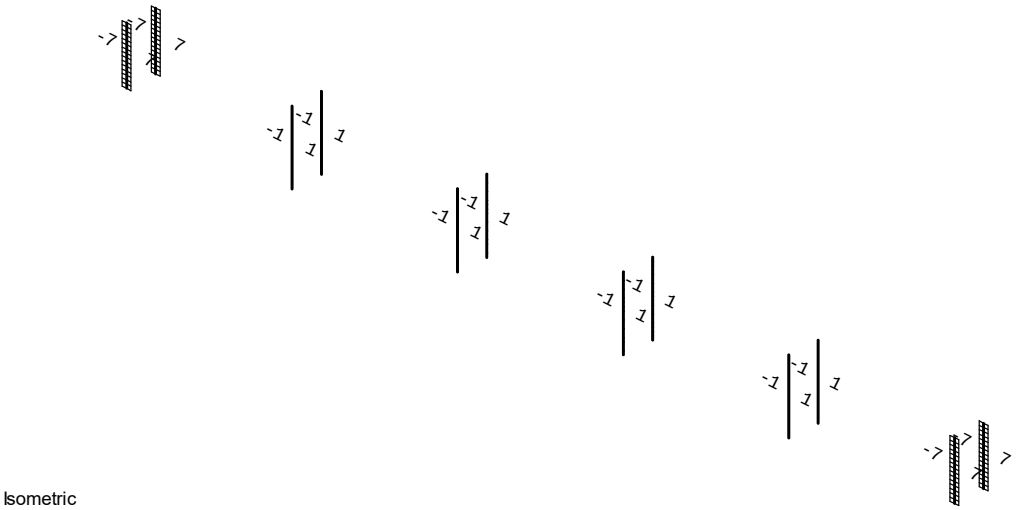
Isometric
Beam Results: max M1= 20 / min M1= -20 kNm

Load 15: Sz



Isometric
Beam Results: max V3= 6 / min V3= -6 kN

Load 15: Sz



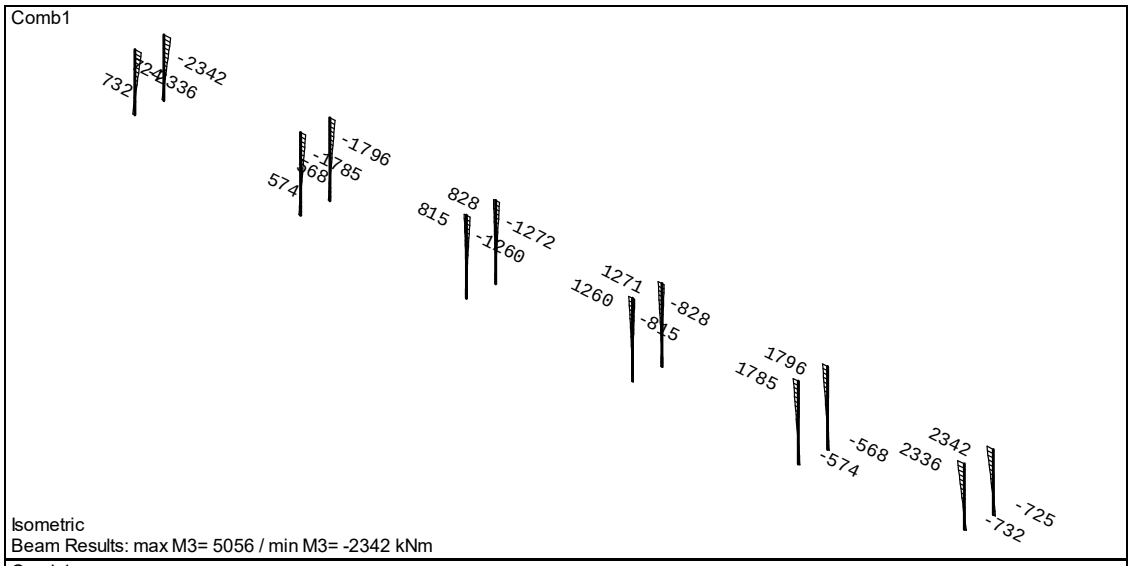
Isometric
Beam Results: max V2= 7 / min V2= -7 kN

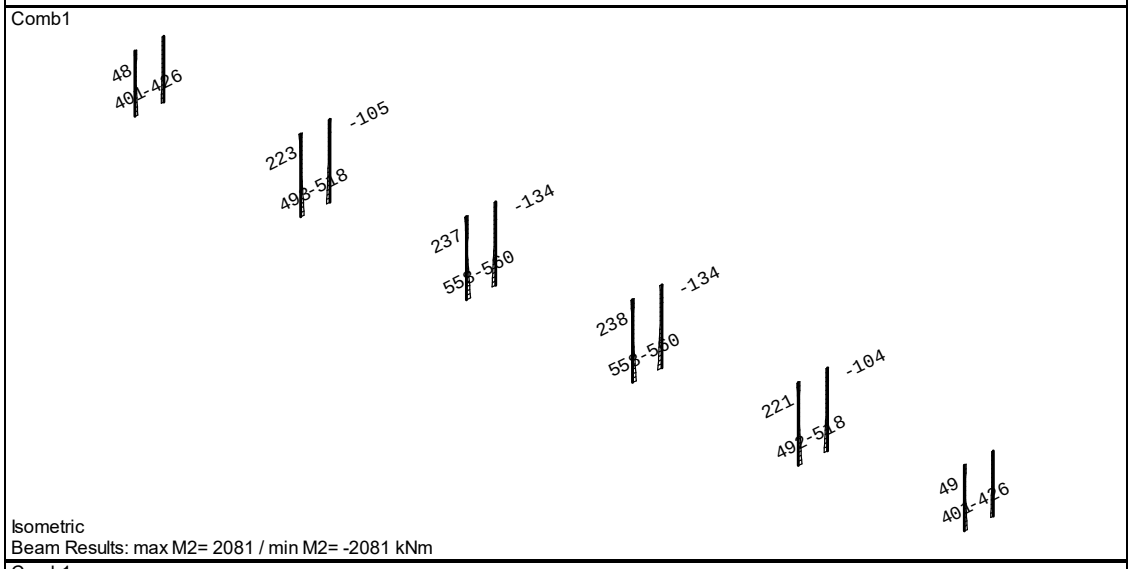
Load 15: Sz

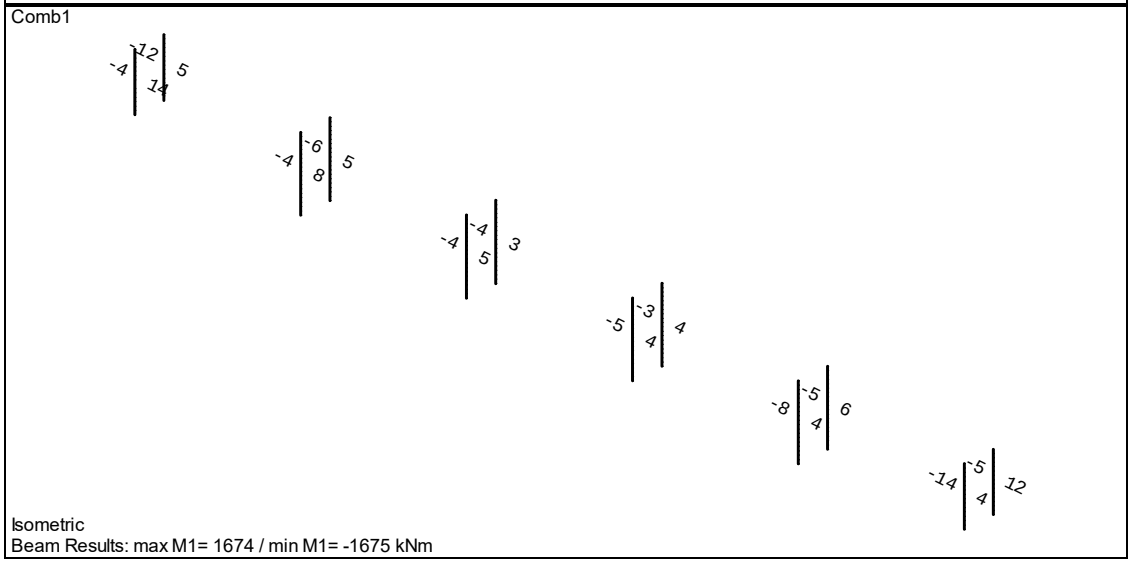
Isometric
Beam Results: max N1= 4 / min N1= -4 kN

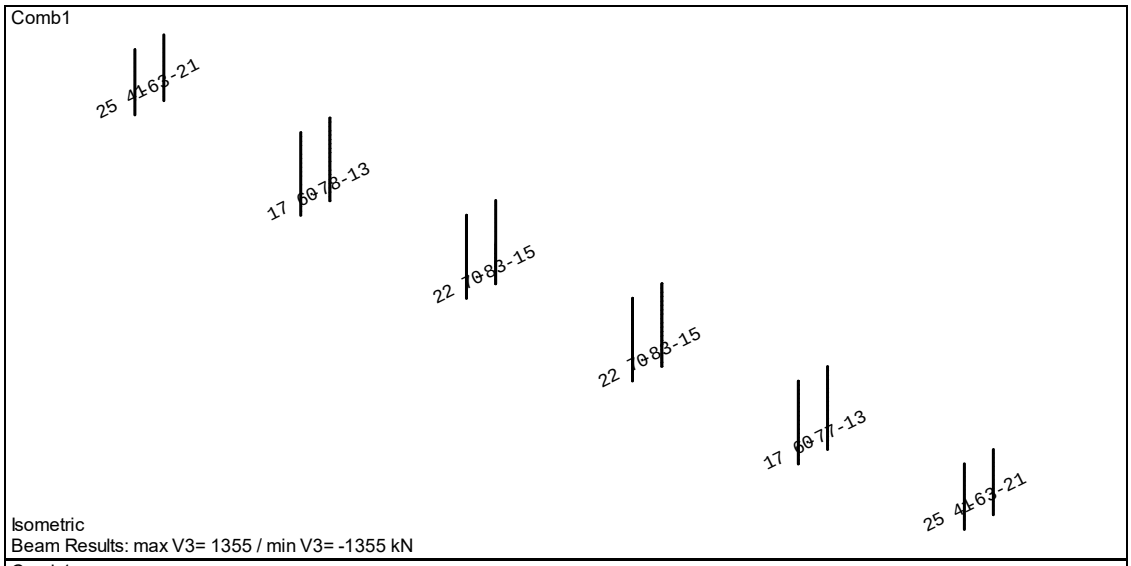
4.6.3.3 Димензионисање / Reinforcement design

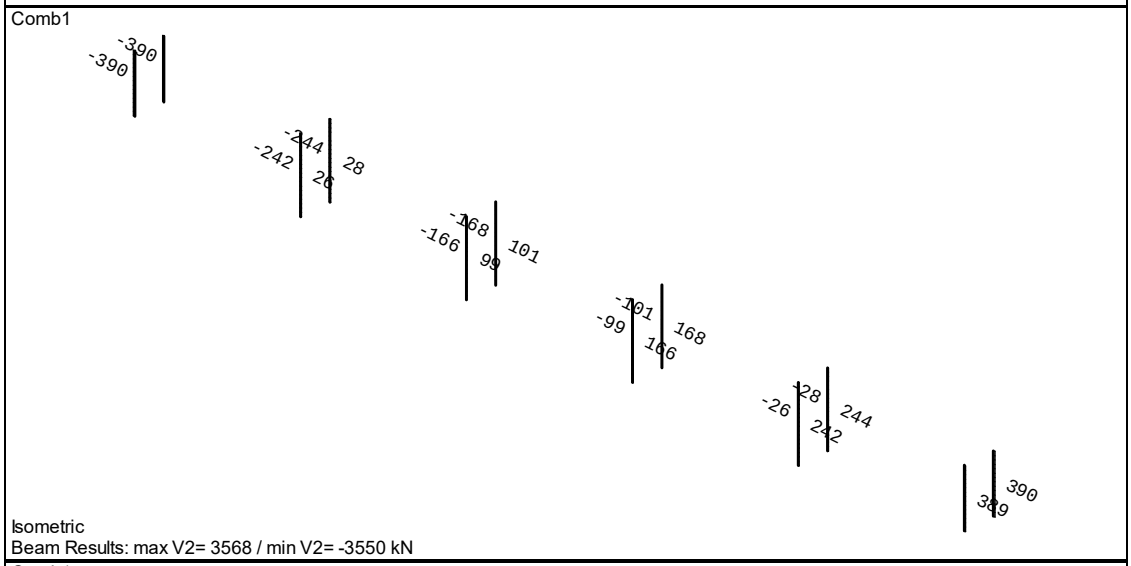
Comb 1

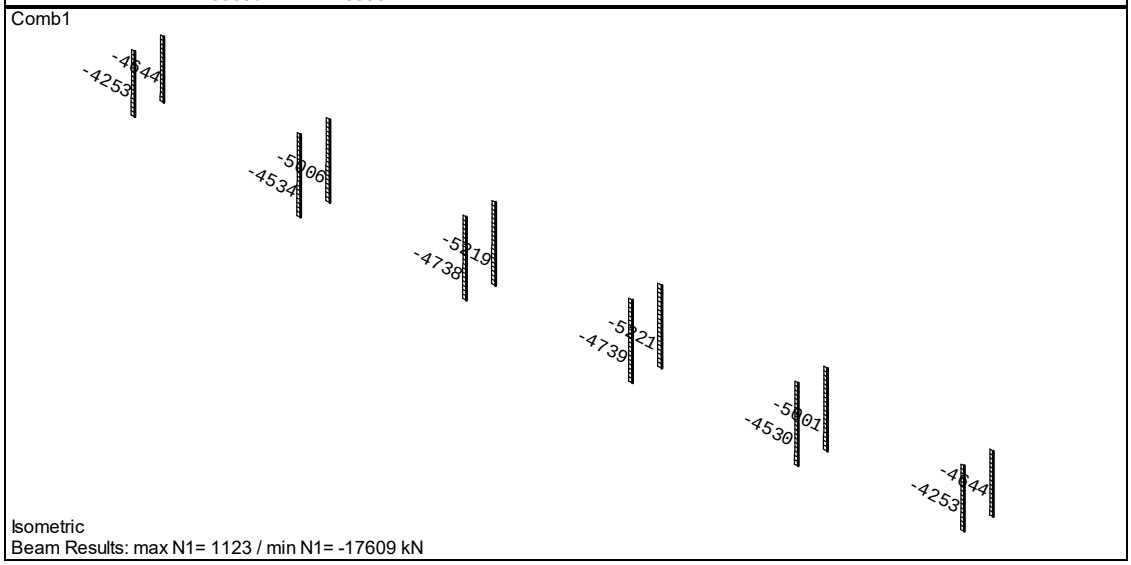

Comb1
-2342
732
-1796
-1785
574
828
815
-1272
-1260
1271
1260
-828
-815
1796
1785
-568
-574
2342
2336
-725
-732
Isometric
Beam Results: max M3= 5056 / min M3= -2342 kNm

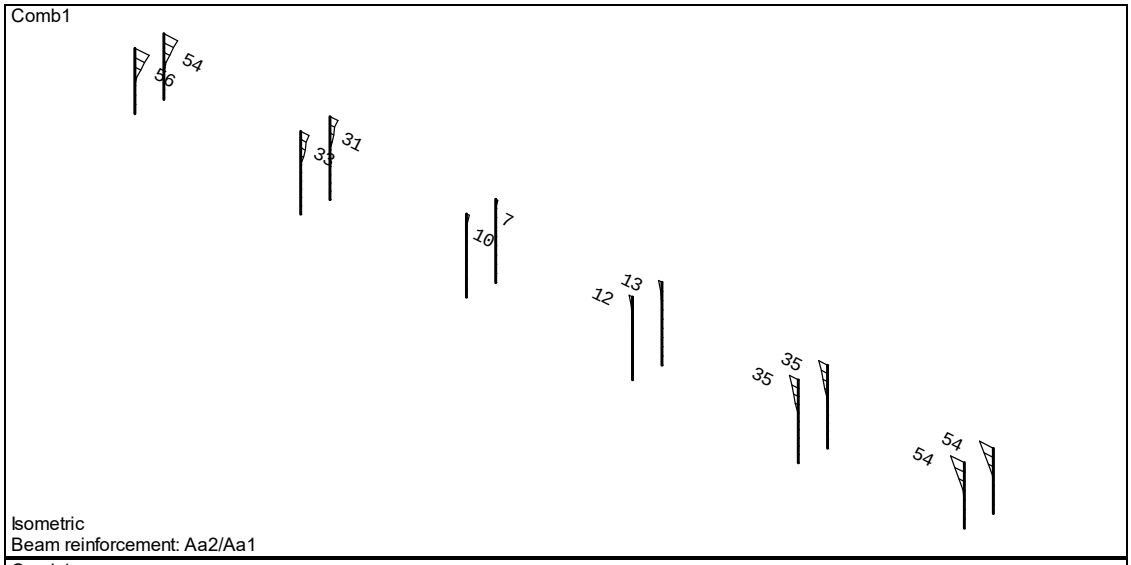

Comb1
48
-426
-105
223
-518
-134
237
-560
-134
238
-560
-104
221
-518
49
-426
Isometric
Beam Results: max M2= 2081 / min M2= -2081 kNm

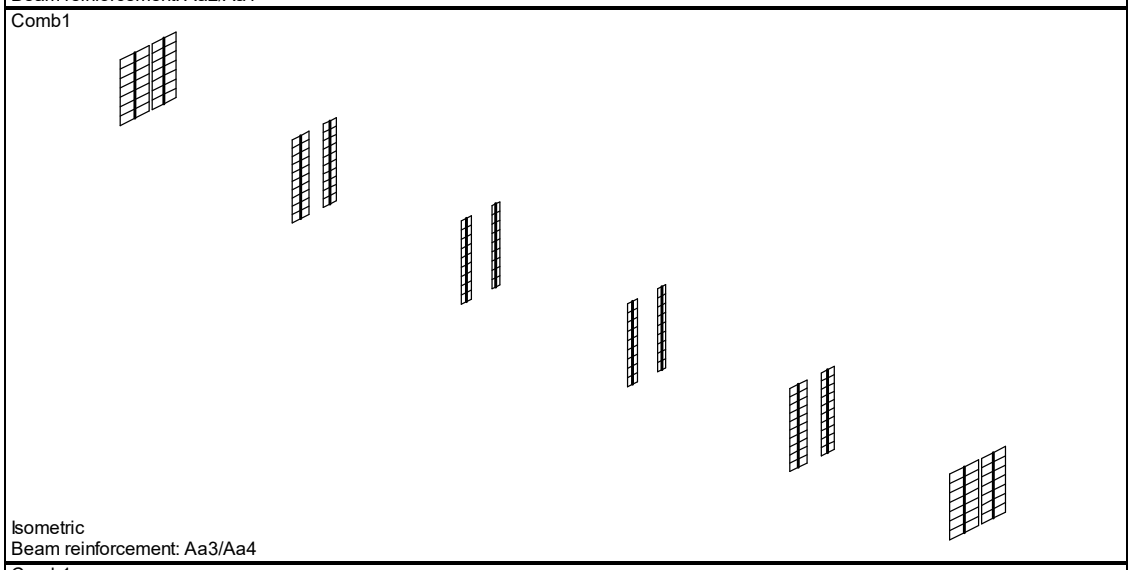

Comb1
-4
-12
14
5
-4
-6
8
5
-4
-4
5
3
-5
-3
4
4
-8
-5
4
6
-14
-5
4
12
Isometric
Beam Results: max M1= 1674 / min M1= -1675 kNm

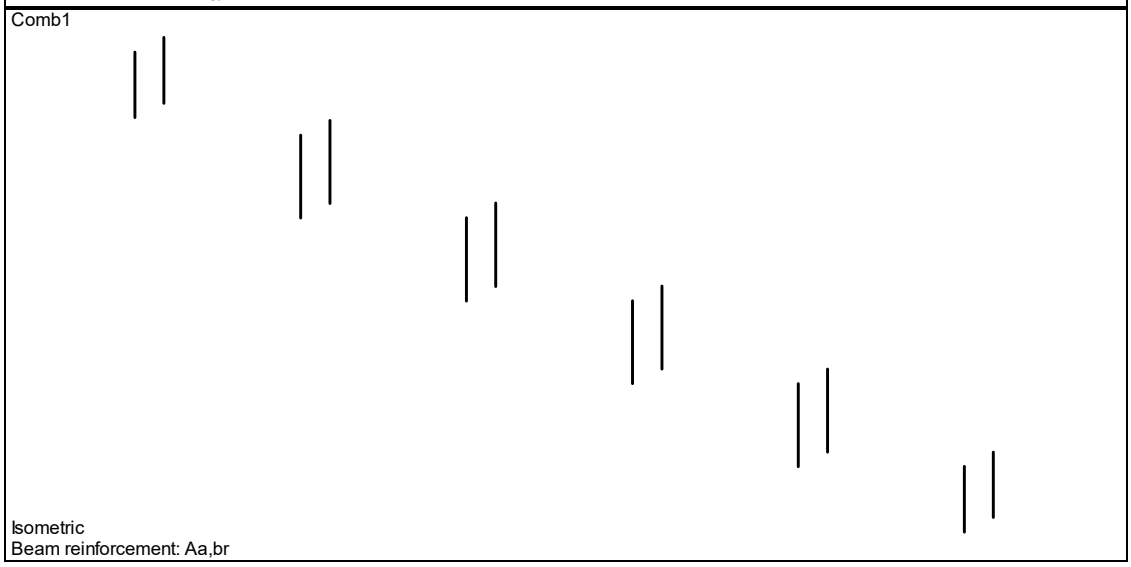

Comb1
25 4163 -21
17 6078 -13
22 7083 -15
22 7083 -15
17 6077 -13
25 4163 -21
Isometric
Beam Results: max V3= 1355 / min V3= -1355 kN


Comb1
-390
-390
-244
-242
28
26
-168
-166
99
101
-101
-99
168
166
28
-26
244
242
390
389
Isometric
Beam Results: max V2= 3568 / min V2= -3550 kN

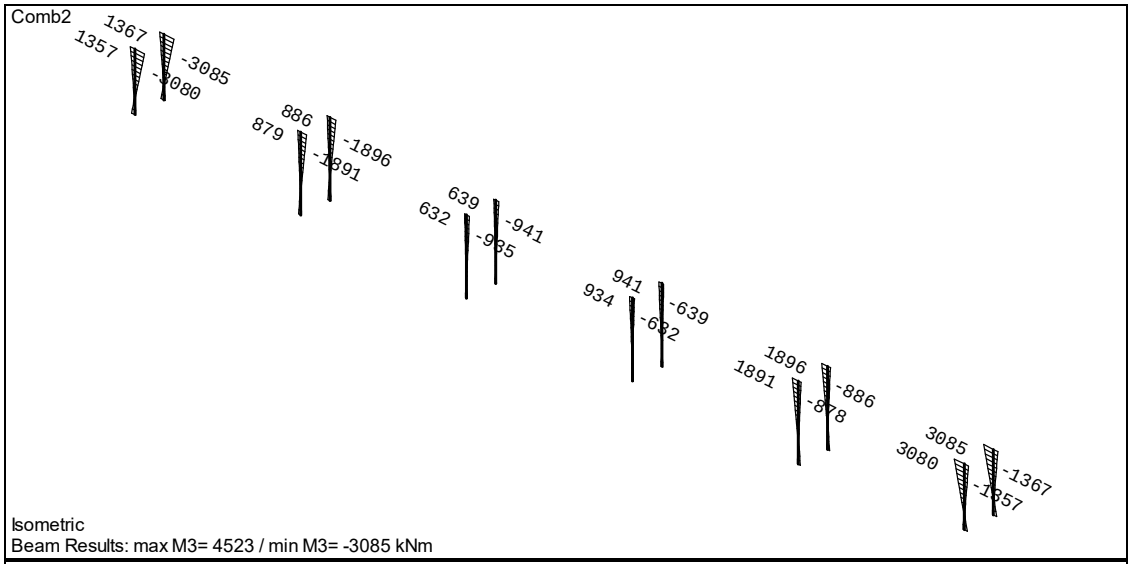

Comb1
-4644
-4253
-5006
-4534
-5319
-4738
-5321
-4739
-5001
-4530
-4644
-4253
Isometric
Beam Results: max N1= 1123 / min N1= -17609 kN

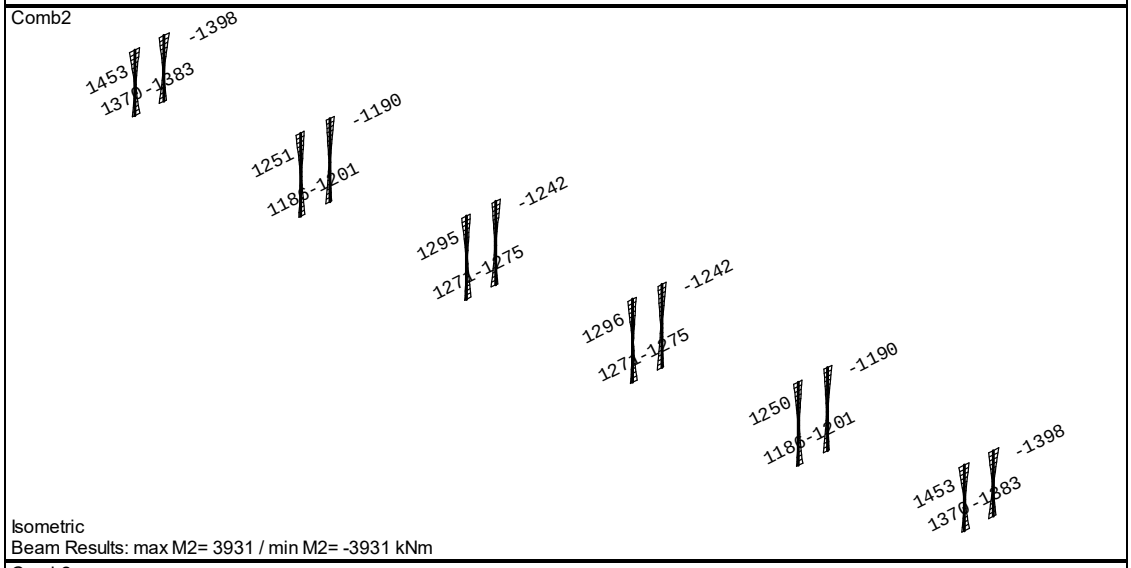

Comb1
54
56
31
32
7
10
13
12
35
35
54
54
Isometric
Beam reinforcement: Aa2/Aa1

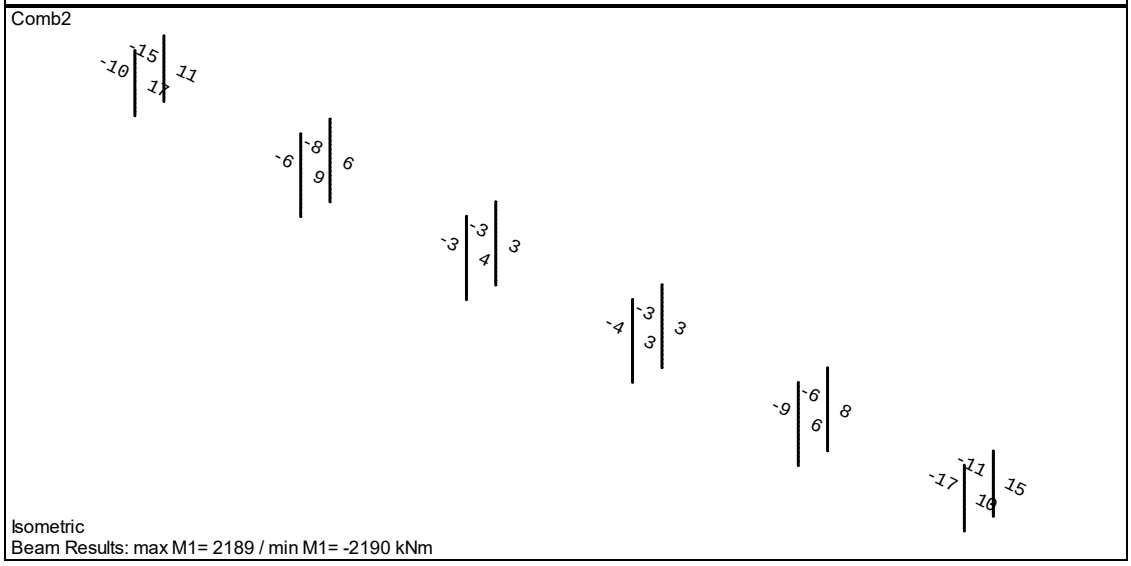

Comb1
Isometric
Beam reinforcement: Aa3/Aa4

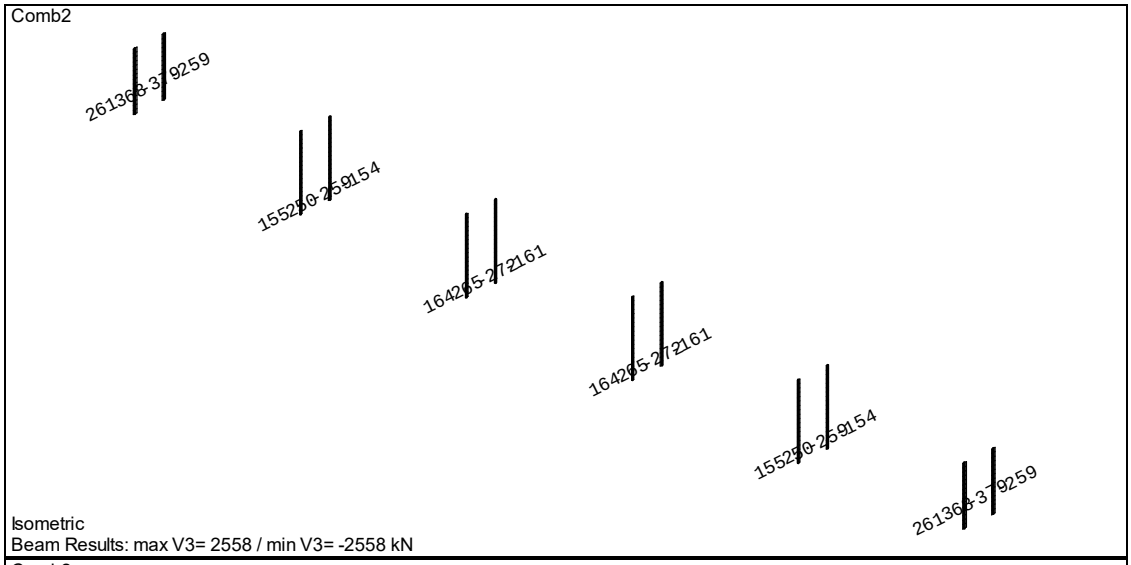

Comb1
Isometric
Beam reinforcement: Aa,br

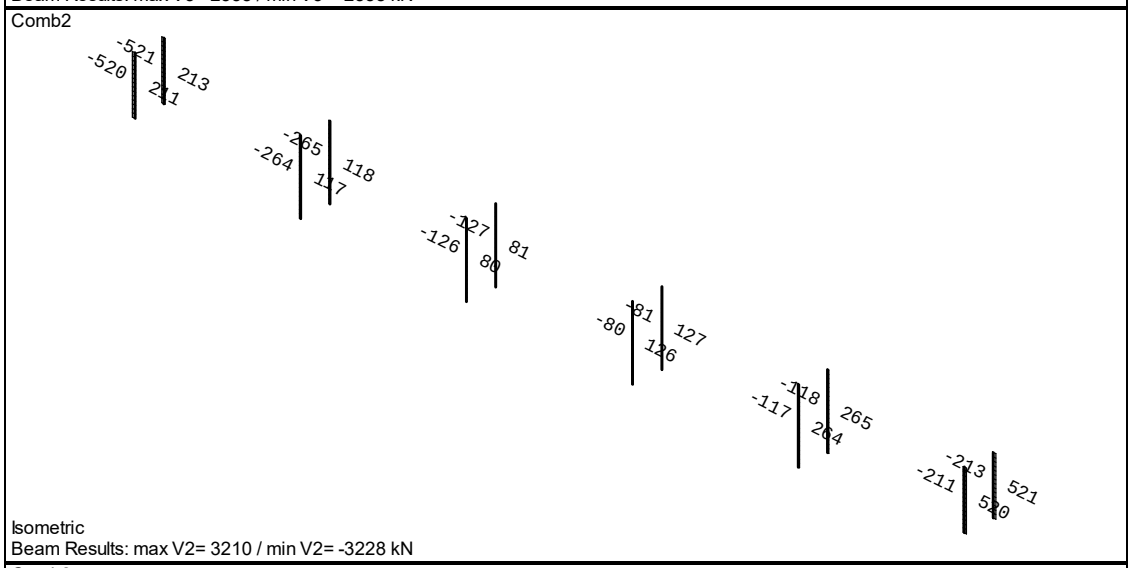
Comb 2

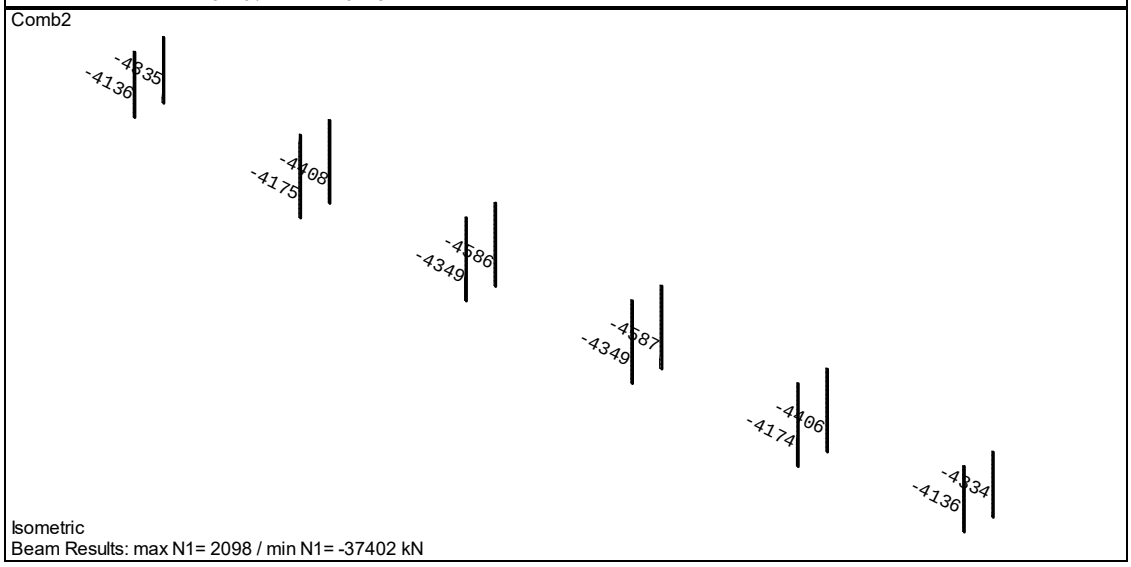

Comb2
1367
1357
-3085
-3080
886
879
-1896
-1891
639
632
-941
-935
941
934
-639
-632
1896
1891
-886
-878
3085
3080
-1367
-1357
Isometric
Beam Results: max M3= 4523 / min M3= -3085 kNm


Comb2
1453
1370
-1398
-1383
1251
1186
-1190
-1201
1295
1271
-1242
-1275
1296
1271
-1242
-1275
1250
1186
-1190
-1201
1453
1370
-1398
-1383
Isometric
Beam Results: max M2= 3931 / min M2= -3931 kNm

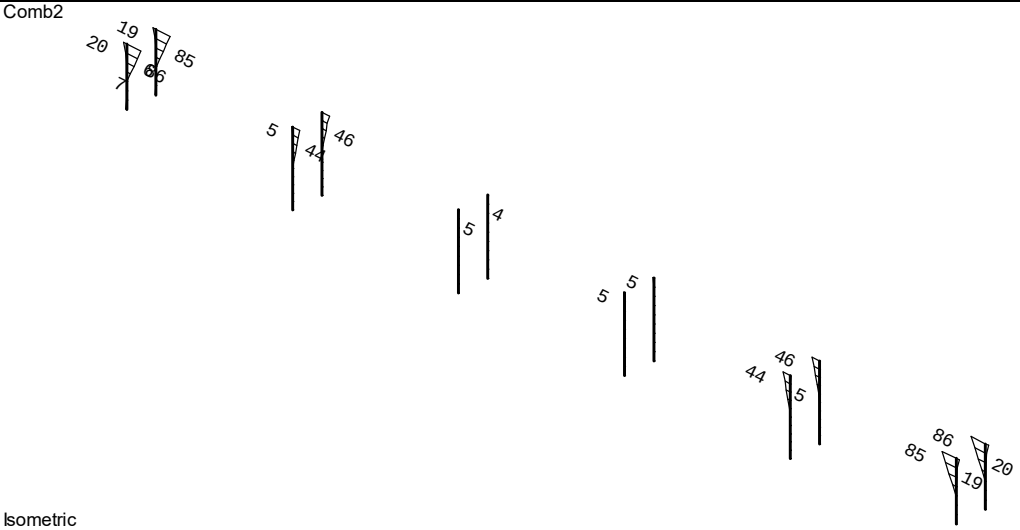

Comb2
-10
-15
11
17
-6
-8
6
9
-3
-3
3
4
-4
-3
3
3
-9
-6
8
6
-17
-11
15
10
Isometric
Beam Results: max M1= 2189 / min M1= -2190 kNm


Comb2
Isometric
Beam Results: max V3= 2558 / min V3= -2558 kN


Comb2
Isometric
Beam Results: max V2= 3210 / min V2= -3228 kN

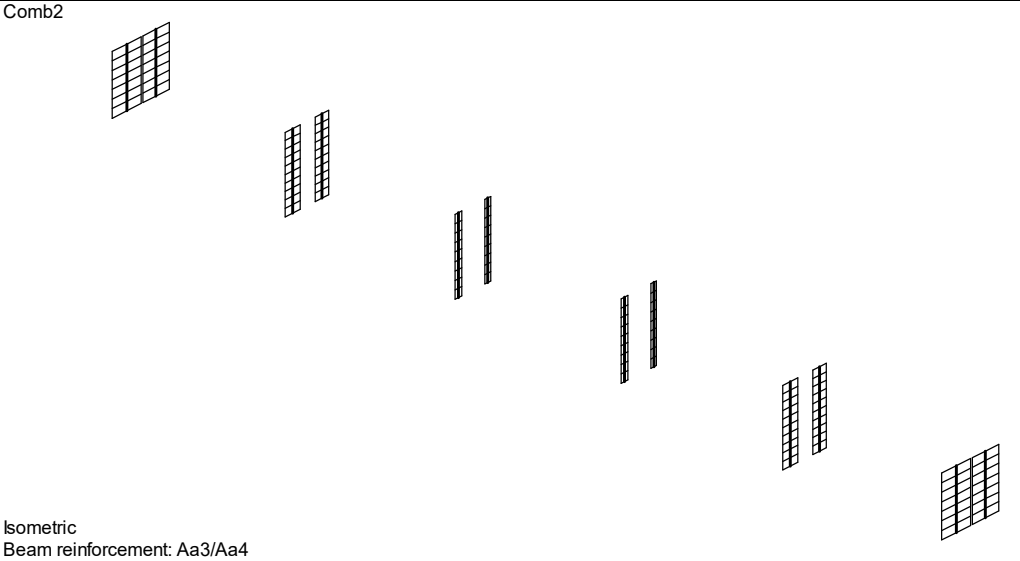

Comb2
Isometric
Beam Results: max N1= 2098 / min N1= -37402 kN

Comb2



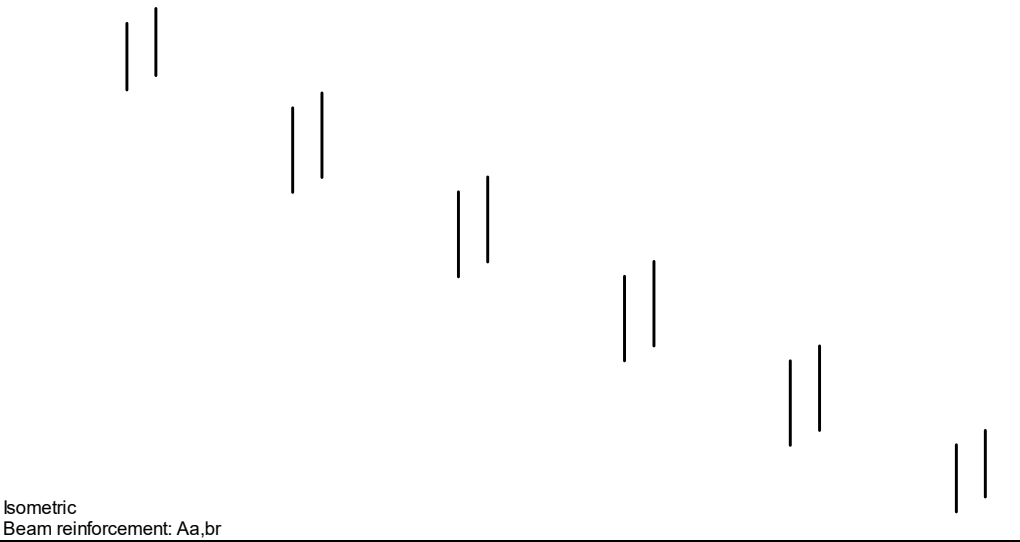
Isometric
Beam reinforcement: Aa2/Aa1

Comb2



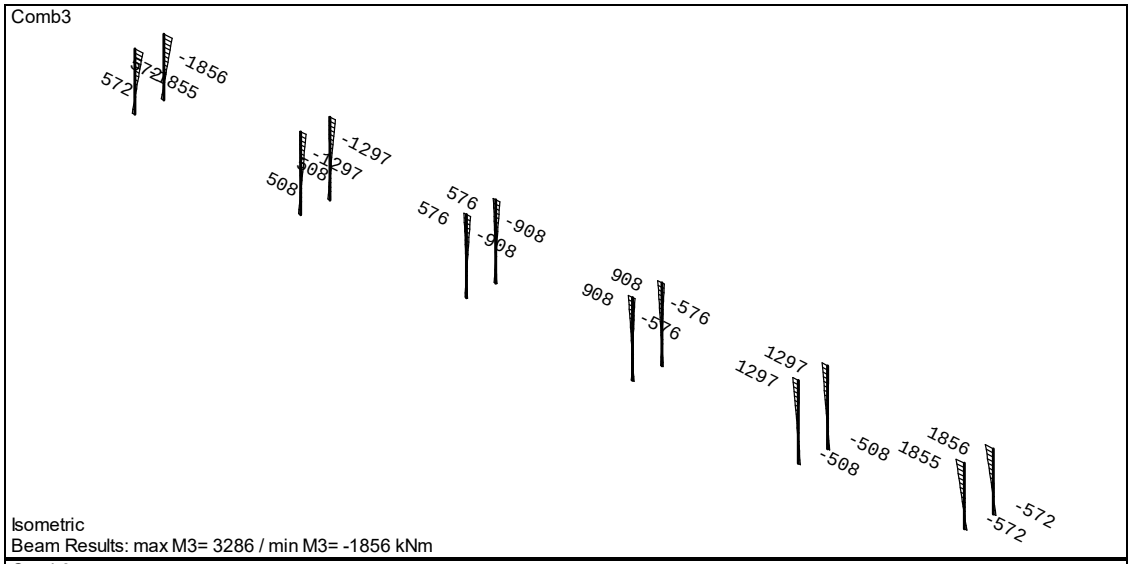
Isometric
Beam reinforcement: Aa3/Aa4

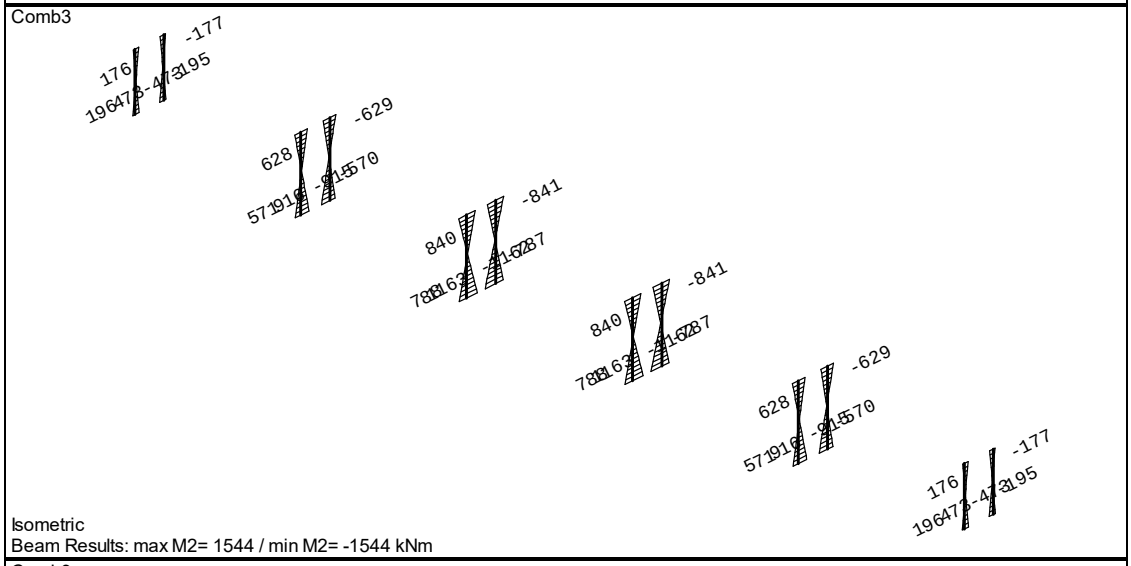
Comb2

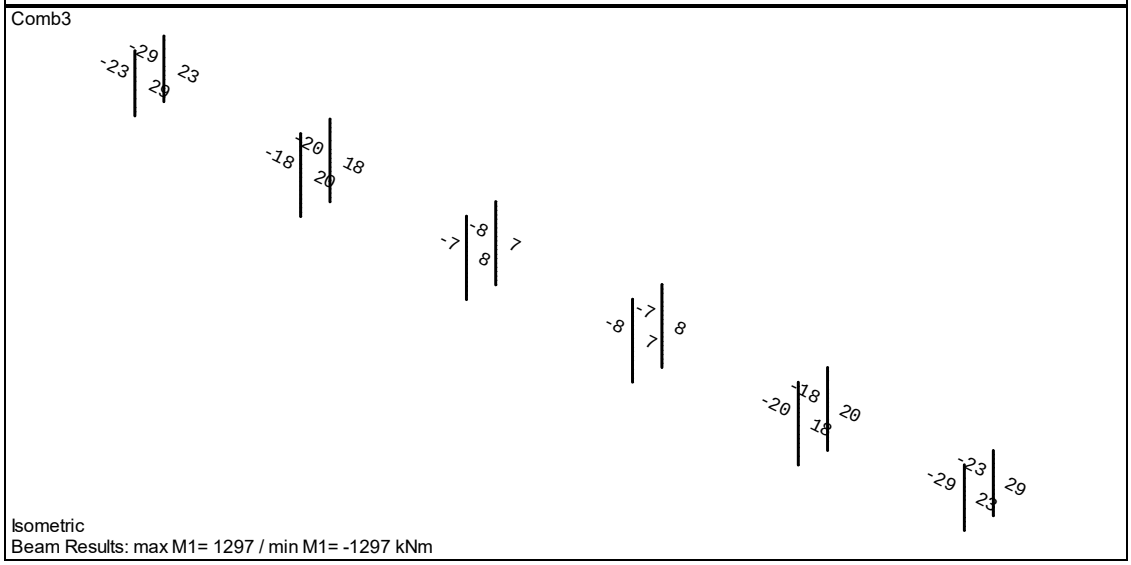


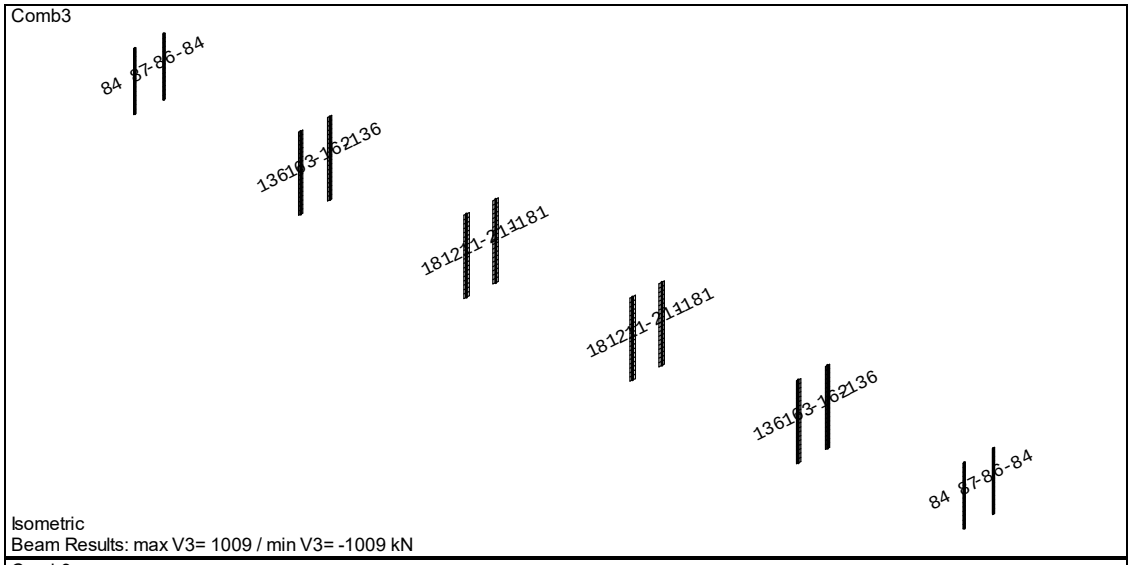
Isometric
Beam reinforcement: Aa,br

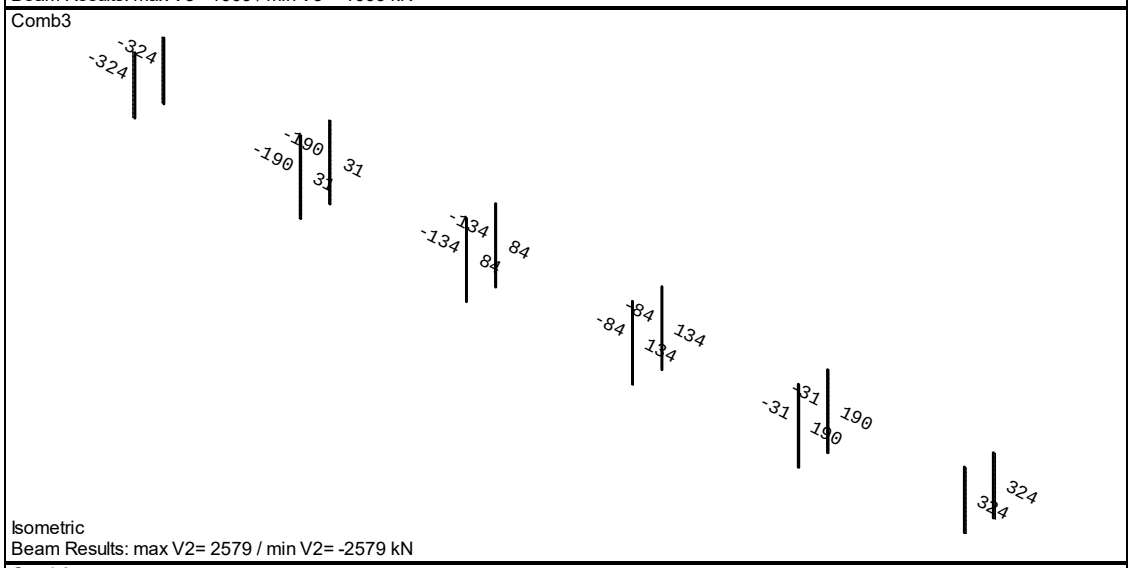
Comb 3

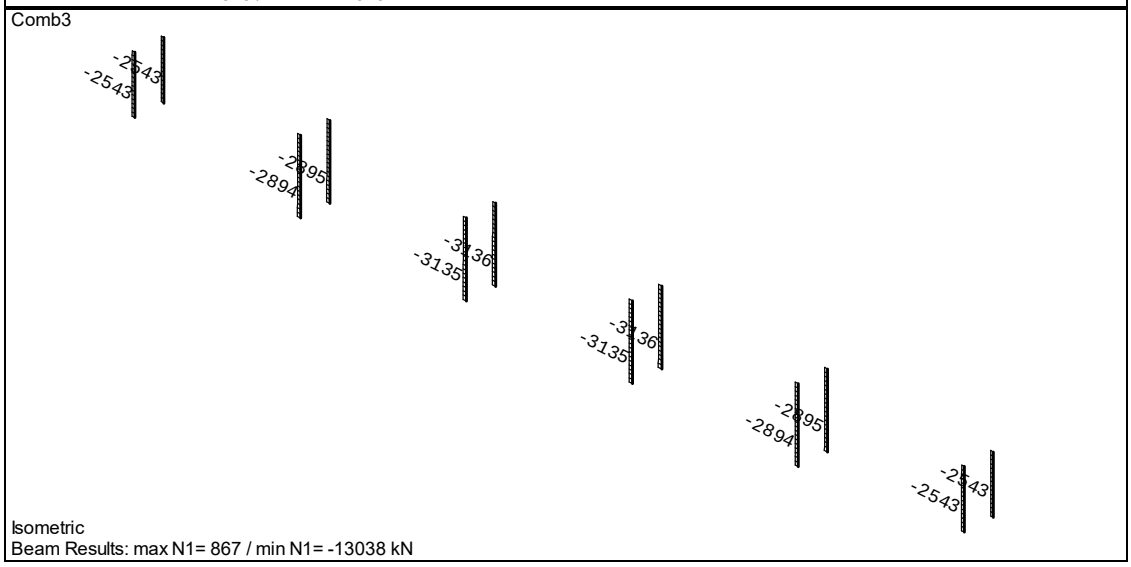

Comb3
-1856
572
1855
-1297
508
576
-908
908
-576
1297
-508
1856
-572
Isometric
Beam Results: max M3= 3286 / min M3= -1856 kNm


Comb3
-177
176
3195
-629
628
570
-841
840
-841
840
-629
628
570
-177
176
3195
Isometric
Beam Results: max M2= 1544 / min M2= -1544 kNm

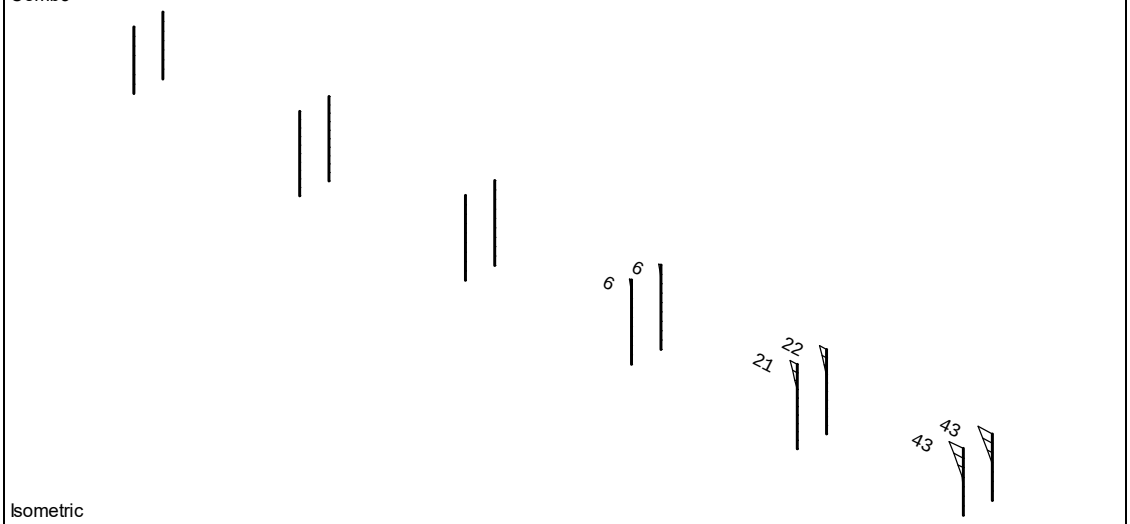

Comb3
-29
-23
23
-20
-18
18
-8
-7
7
-7
-8
8
-18
-20
20
-23
-29
29
Isometric
Beam Results: max M1= 1297 / min M1= -1297 kNm


Comb3
84 87-86-84
136163-162136
181211-211181
181211-211181
136163-162136
84 87-86-84
Isometric
Beam Results: max V3= 1009 / min V3= -1009 kN


Comb3
-324 -324
-190 -190 31 31
-134 -134 84 84
-84 -84 134 134
-31 -31 190 190
324 324
Isometric
Beam Results: max V2= 2579 / min V2= -2579 kN

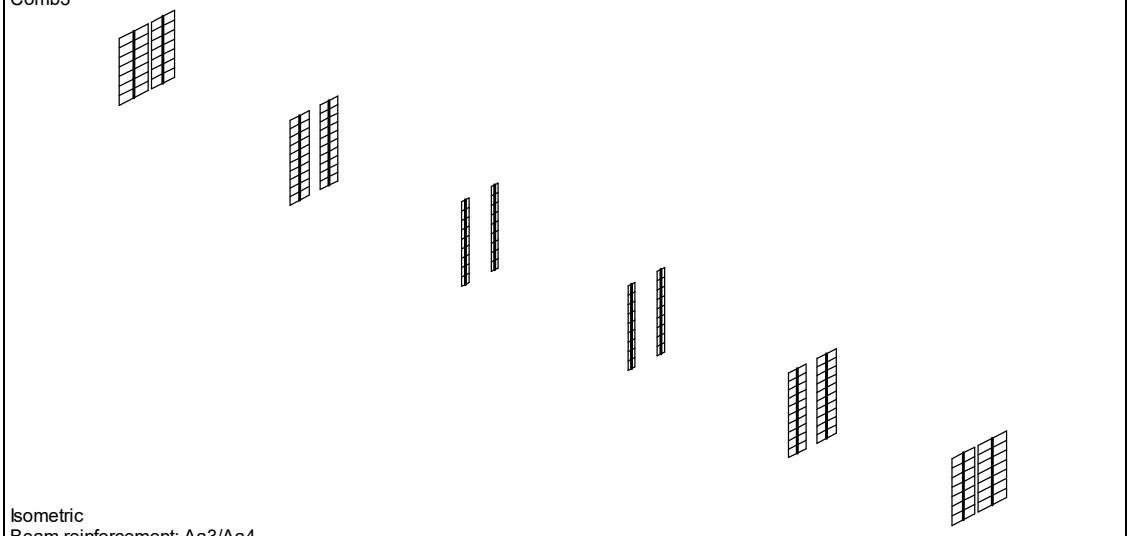

Comb3
-2543 -2543
-2894 -2895
-3135 -3136
-3135 -3136
-2894 -2895
-2543 -2543
Isometric
Beam Results: max N1= 867 / min N1= -13038 kN

Comb3



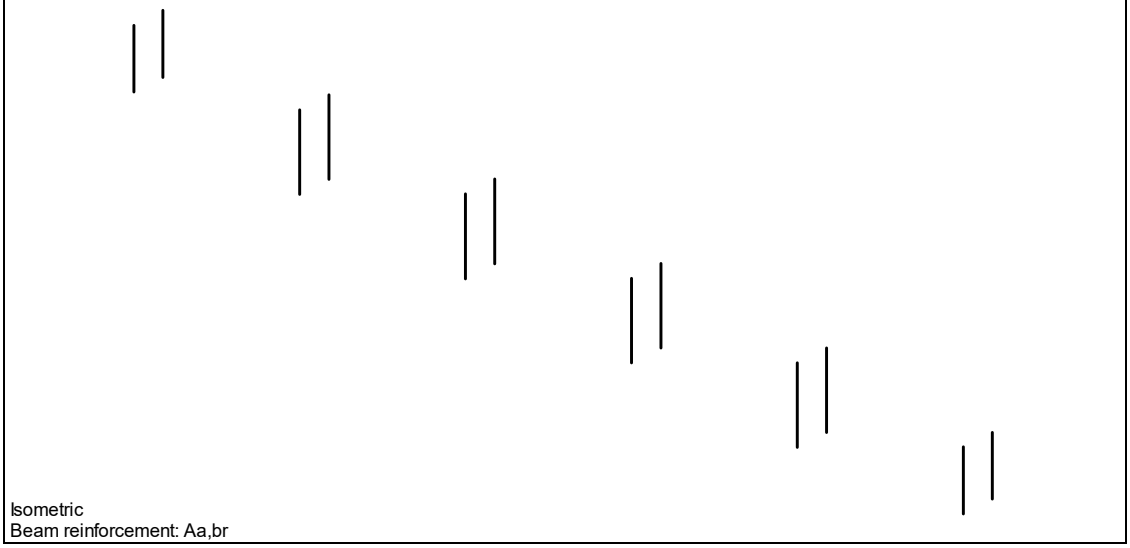
Isometric
Beam reinforcement: Aa2/Aa1

Comb3



Isometric
Beam reinforcement: Aa3/Aa4

Comb3



Isometric
Beam reinforcement: Aa,br

Потребна арматура / required reinforcement

Стубови С2, С7 / Piers S2, S7

Вертикална арматура / Vertical reinforcement

Aa1,2max = 86 cm2

Aa3,4max = 0 cm2

Смичућа арматура / Shear reinforcement

Aa = 0 cm2/m

Минимална арматура / Minimum reinforcement

160x80 cm → Ac = 12800 cm2

Aa,min = 0.003xAc = 0.003x12800 = 38.4 cm2

Aa,min = 0.15xNed/fyd = (0.15x4644)/(50/1.15) = 16.02 cm2 **Усвојена арматура** / provided reinforcement :

Вертикална арматура / Vertical reinforcement

Aa1,2 → ±14Φ28/10 → Aa = 86.10 cm2

Aa3,4 → ±6Φ28/10 → Aa = 36.90 cm2

Смичућа арматура / Shear reinforcement

Aa = Φ12/10 → Aa = 11.30 cm/m → 1.0 m **На врху и дну /** at top and bottom

Aa = Φ12/15 → Aa = 7.53 cm/m → **у средини /** in the middle

Стубови С3 – С6 / Piers S3 – S6

Вертикална арматура / Vertical reinforcement

Aa1,2max = 46 cm2

Aa3,4max = 0 cm2

Смичућа арматура / Shear reinforcement

Aa = 0 cm2/m

Минимална арматура / Minimum reinforcement

160x80 cm → Ac = 12800 cm2

Aa,min = 0.003xAc = 0.003x12800 = 38.4 cm2

Aa,min = 0.15xNed/fyd = (0.15x5221)/(50/1.15) = 18.01 cm2 **Усвојена арматура** / provided reinforcement :

Вертикална арматура / Vertical reinforcement

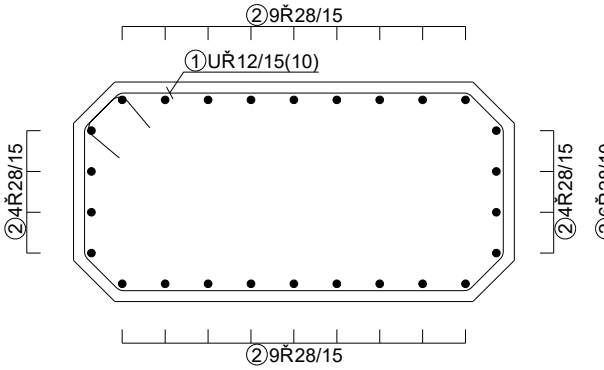
Aa1,2 → ±9Φ28/15 → Aa = 55.35cm2

Aa3,4 → ±4Φ28/15 → Aa = 24.60 cm2

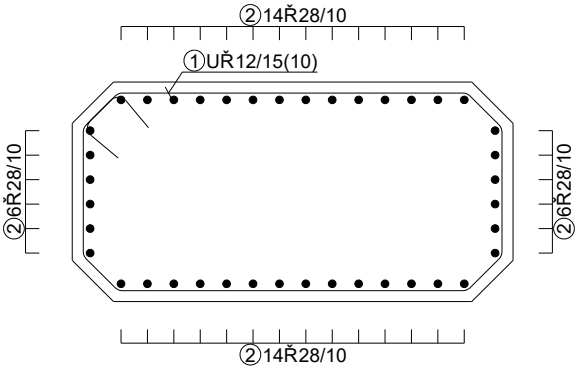
Смичућа арматура / Shear reinforcement

Aa = Φ12/10 → Aa = 11.30 cm/m → 1.0 m **На врху и дну /** at top and bottom

Aa = Φ12/15 → Aa = 7.53 cm/m → **у средини /** in the middle



Стубови С3 – С6 / Piers S3 – S6



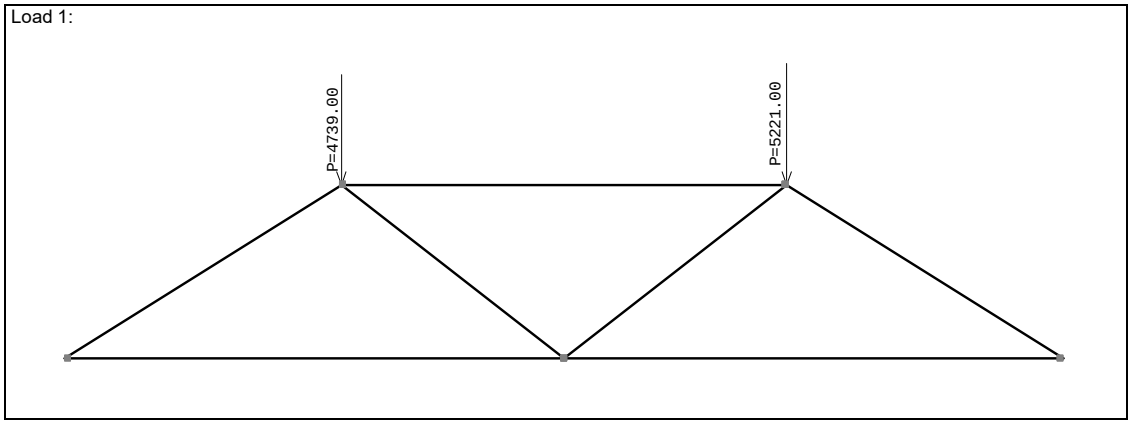
Стубови С2, С7 / Piers S2, S7

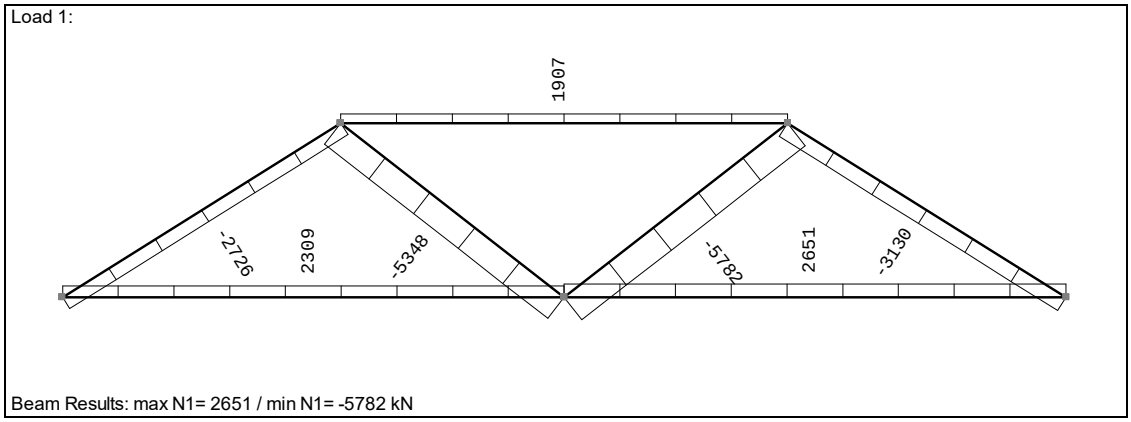
4.6.4 Темељи / Foundations

Користи се метод замењујуће решетке / strut-and-tie method

Меродавна је максимална аксијална сила у стубу / Maximum axial force in column e is relevant

Nd,max = 5221 kN , (4739 kN)





Потребна арматура / required reinforcement

Подужна арматура / Longitudinal reinforcement

Доња зона / Bottom zone

Z = 2651 kN

Aa = 2651/50/1.15 = 60.97 cm2

Усвојена арматура / provided reinforcement :

12Φ25/15 → Aa = 58.89 cm2

Горња зона / Upper zone

Z = 1866 kN

Aa = 1907/50/1.15 = 43.86 cm2

Усвојена арматура / provided reinforcement :

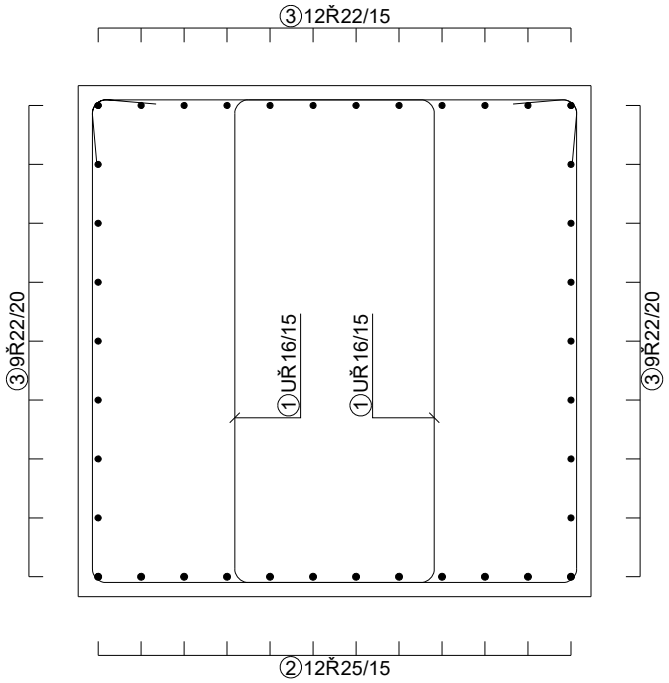
12Φ22/15 → Aa = 45.60 cm2

Смичућа арматура / Shear reinforcement

Све дијагонале су притиснуте / All diagonals are pressured

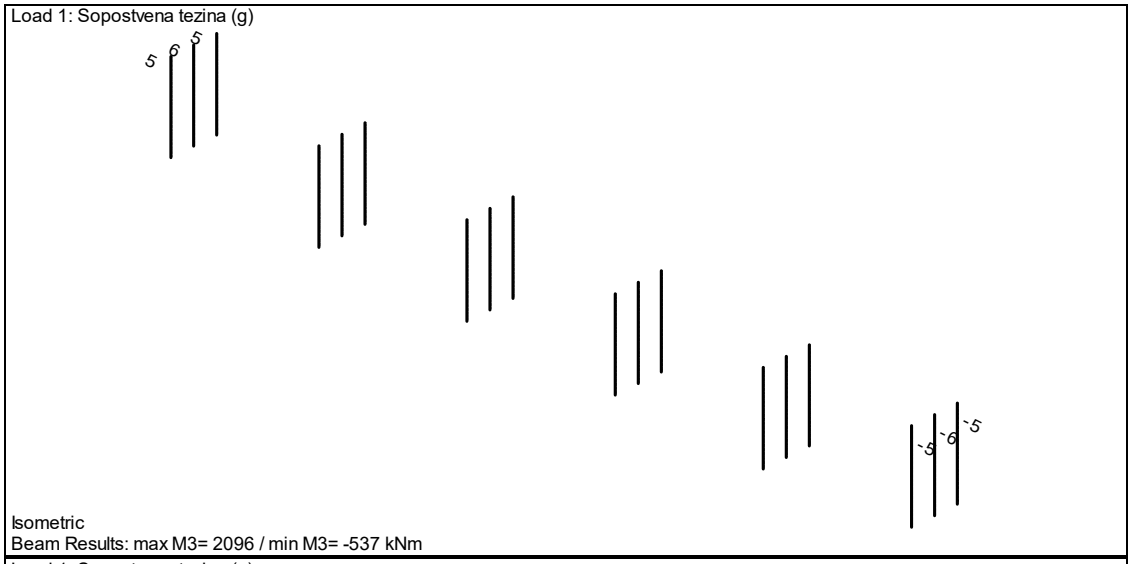
Усвојена арматура / provided reinforcement :

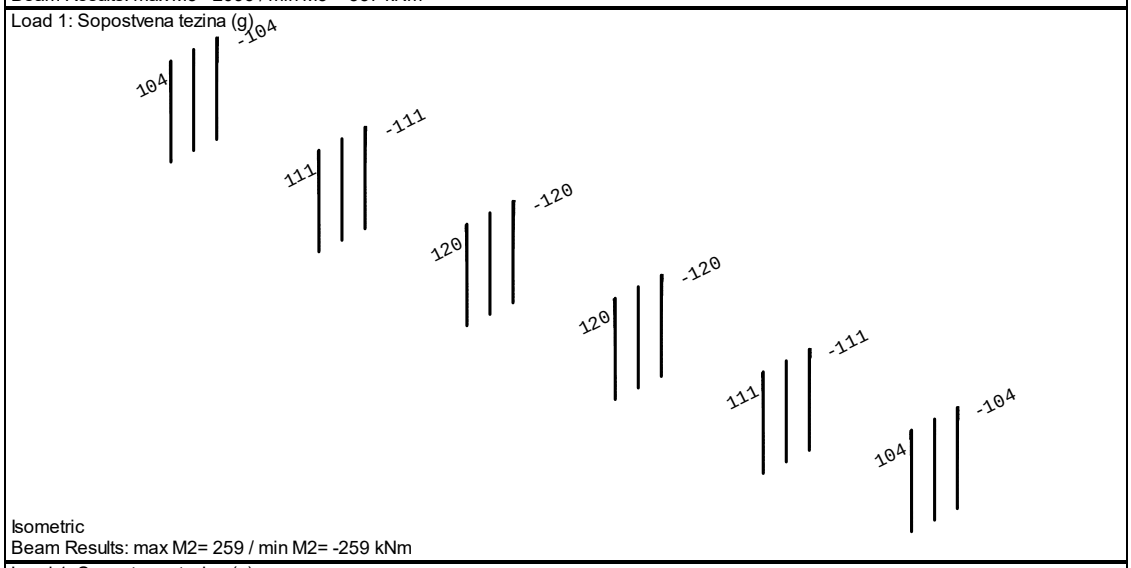
2xΦ16/15 → Aa = 13.40x2 = 26.80 cm2/m

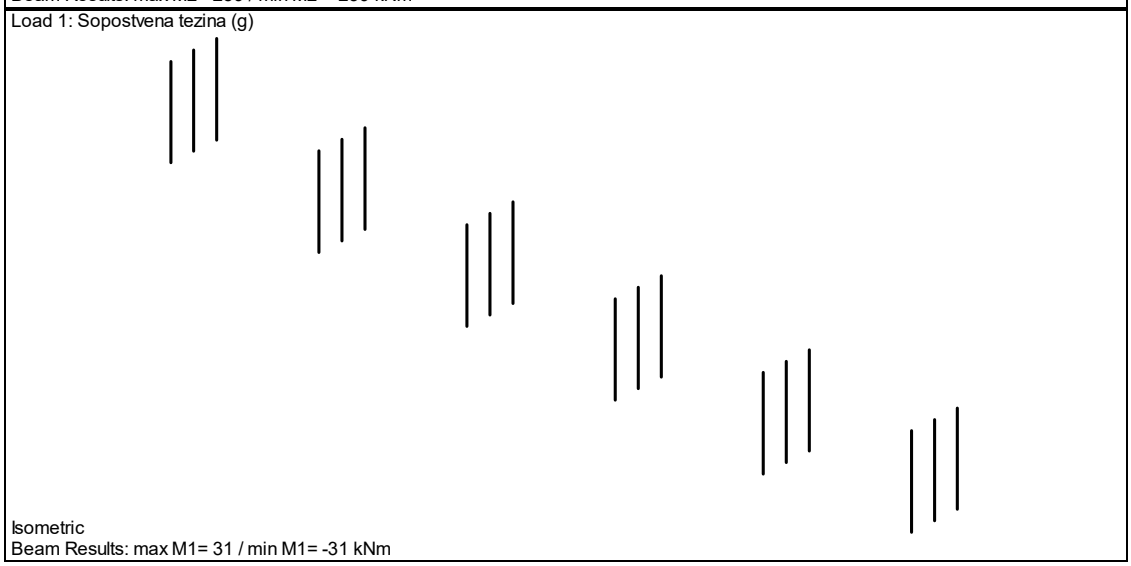


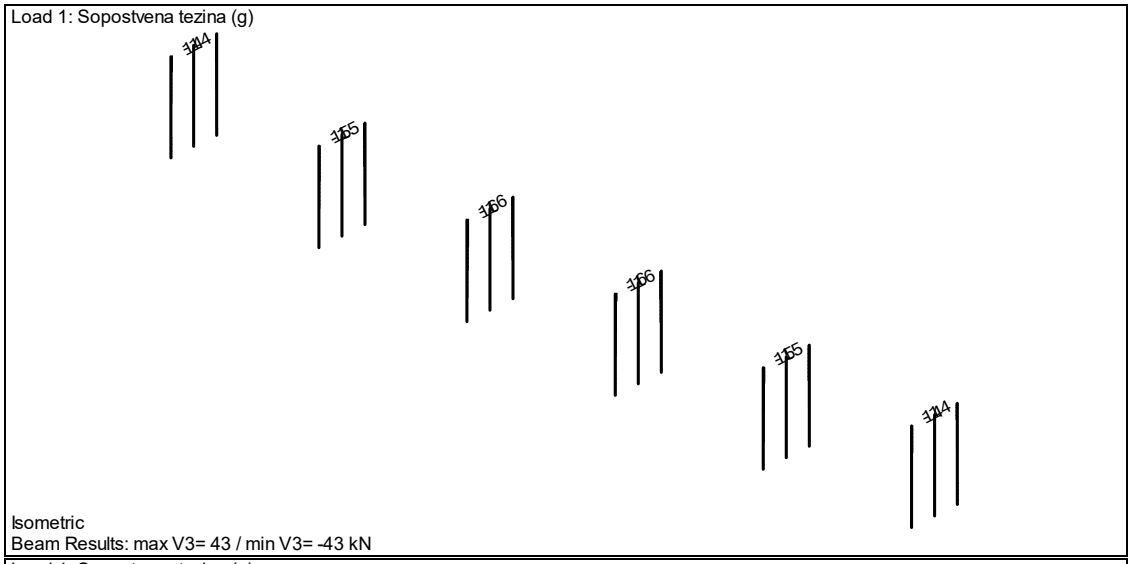
4.6.5 Шипови / Piles

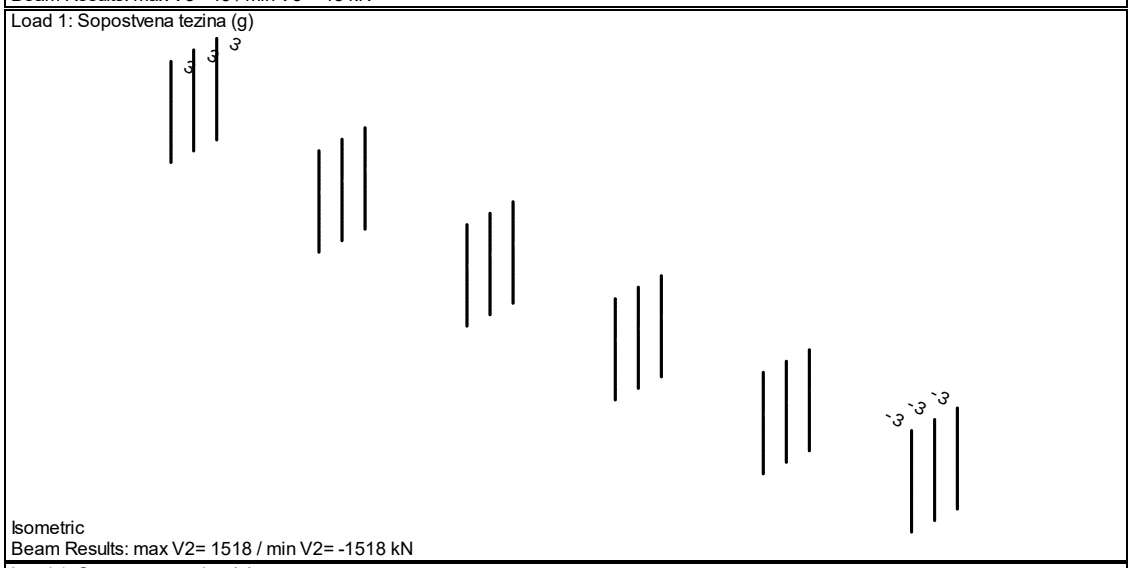
4.6.5.1 **Пресечне силе и деформације /** Internal forces and deformations

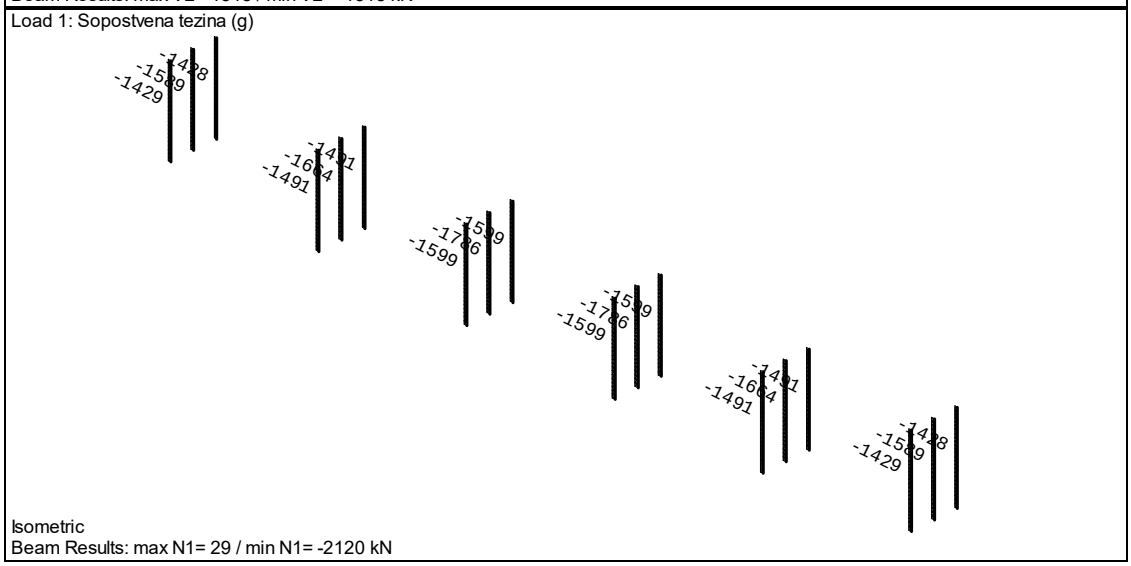




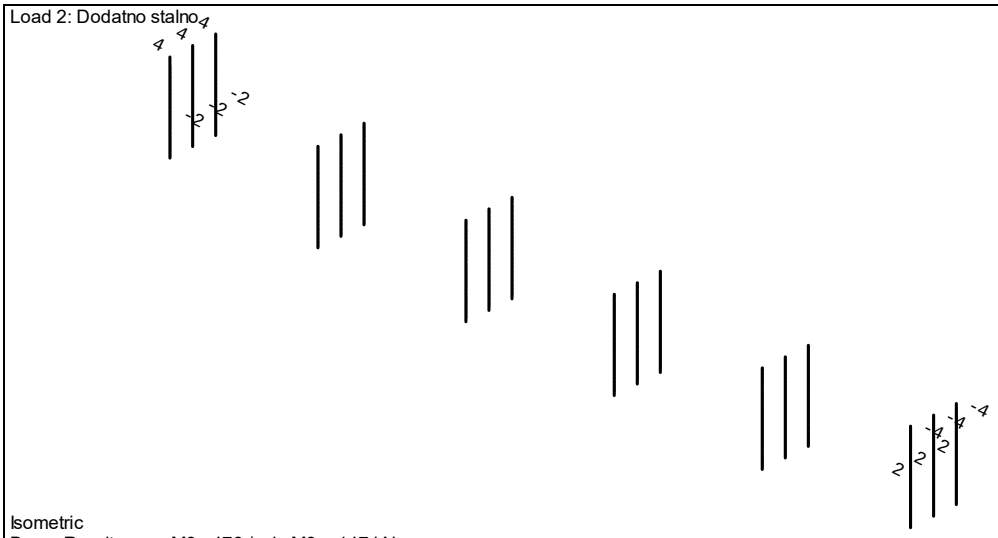



Load 1: Sopostvena tezina (g)
Isometric
Beam Results: max V3= 43 / min V3= -43 kN


Load 1: Sopostvena tezina (g)
Isometric
Beam Results: max V2= 1518 / min V2= -1518 kN

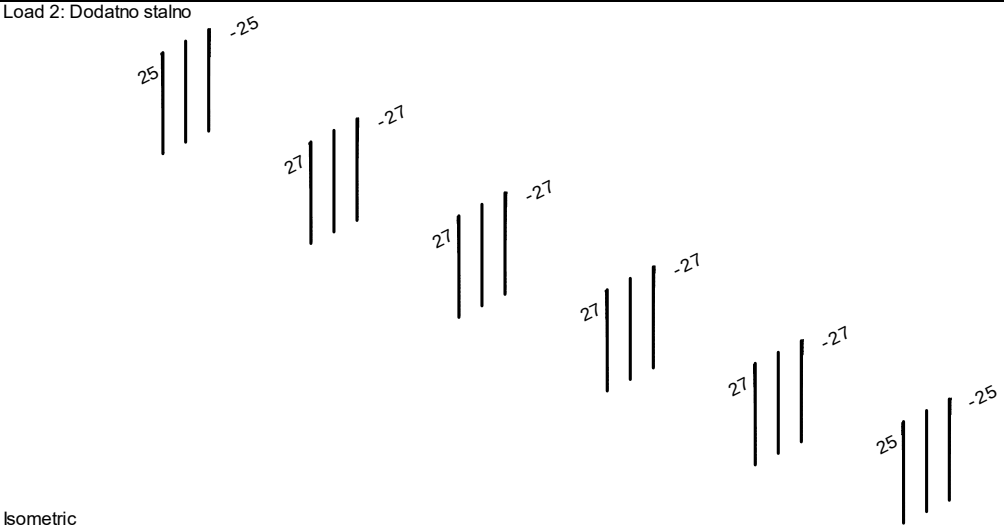

Load 1: Sopostvena tezina (g)
Isometric
Beam Results: max N1= 29 / min N1= -2120 kN

Load 2: Dodatno stalno



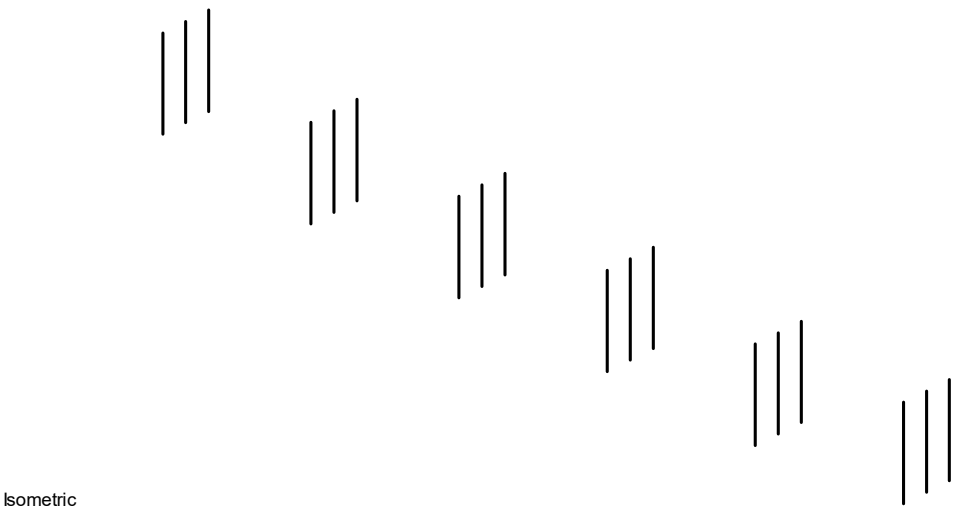
Isometric
Beam Results: max M3= 476 / min M3= -147 kNm

Load 2: Dodatno stalno

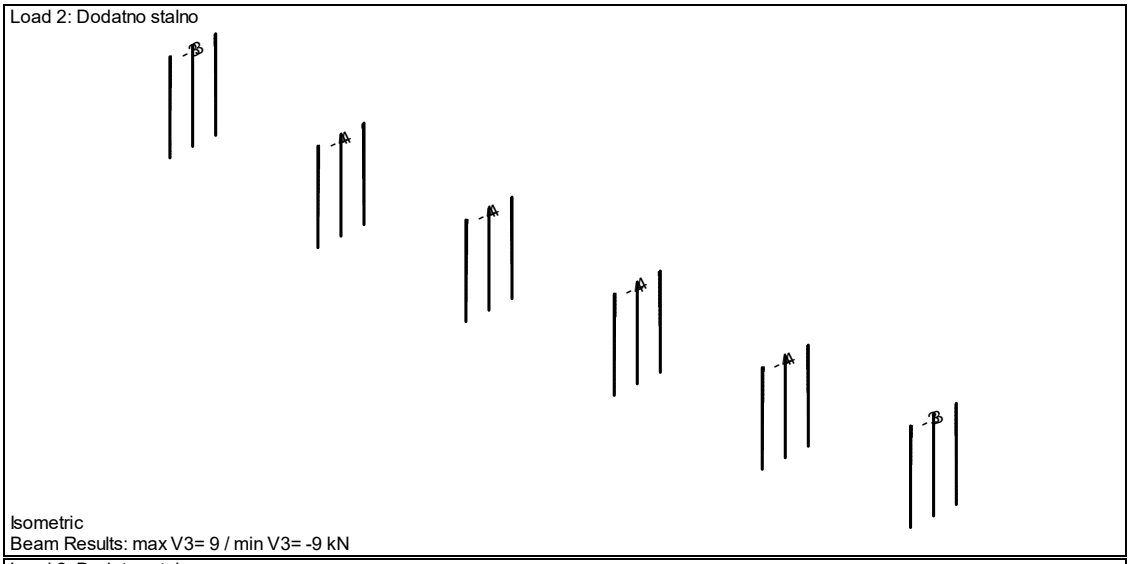


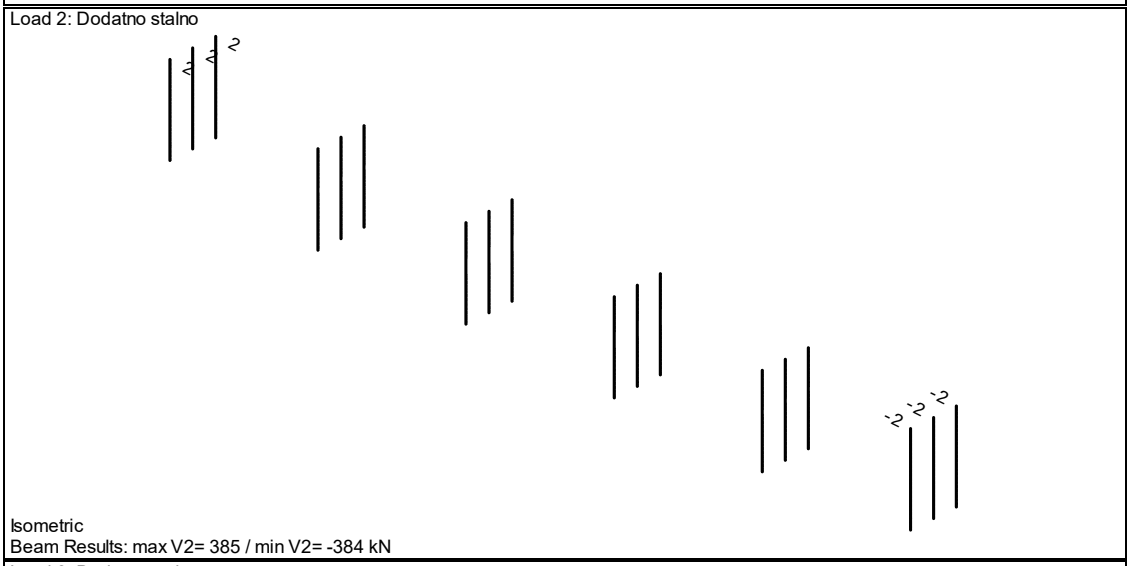
Isometric
Beam Results: max M2= 58 / min M2= -58 kNm

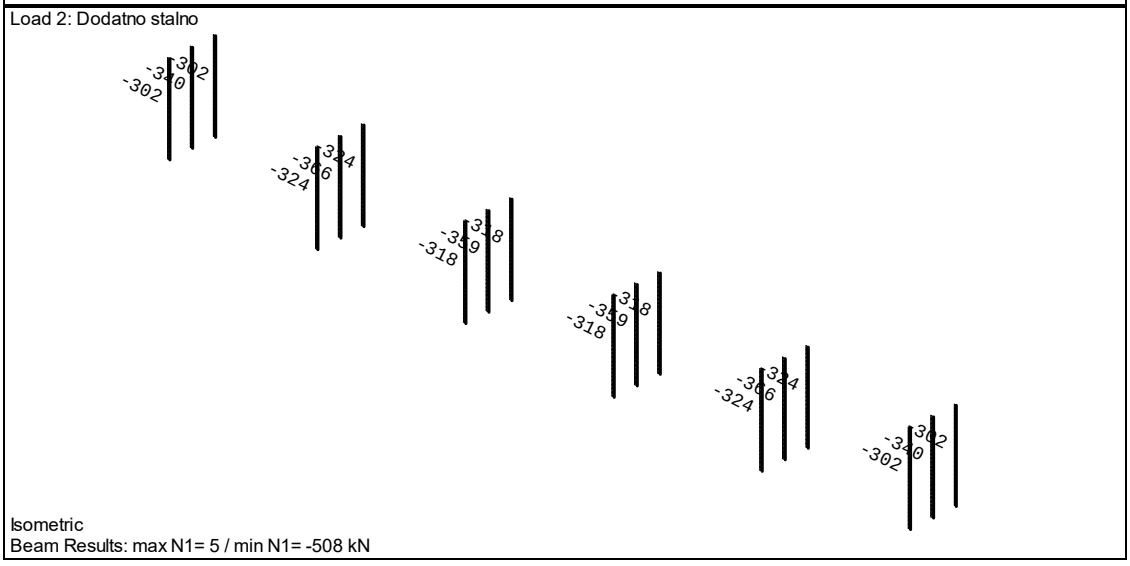
Load 2: Dodatno stalno

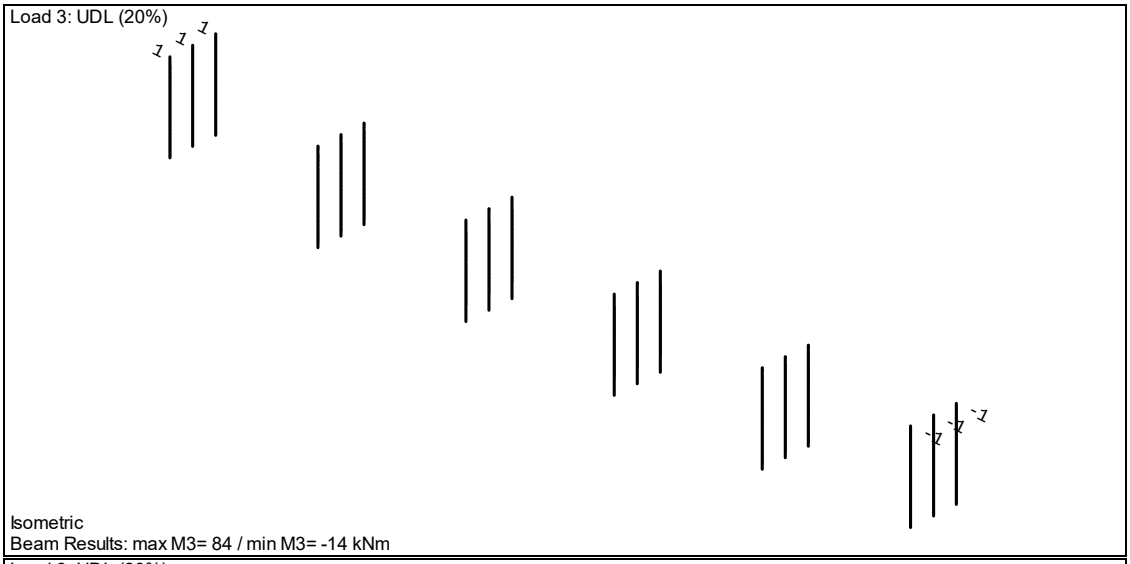


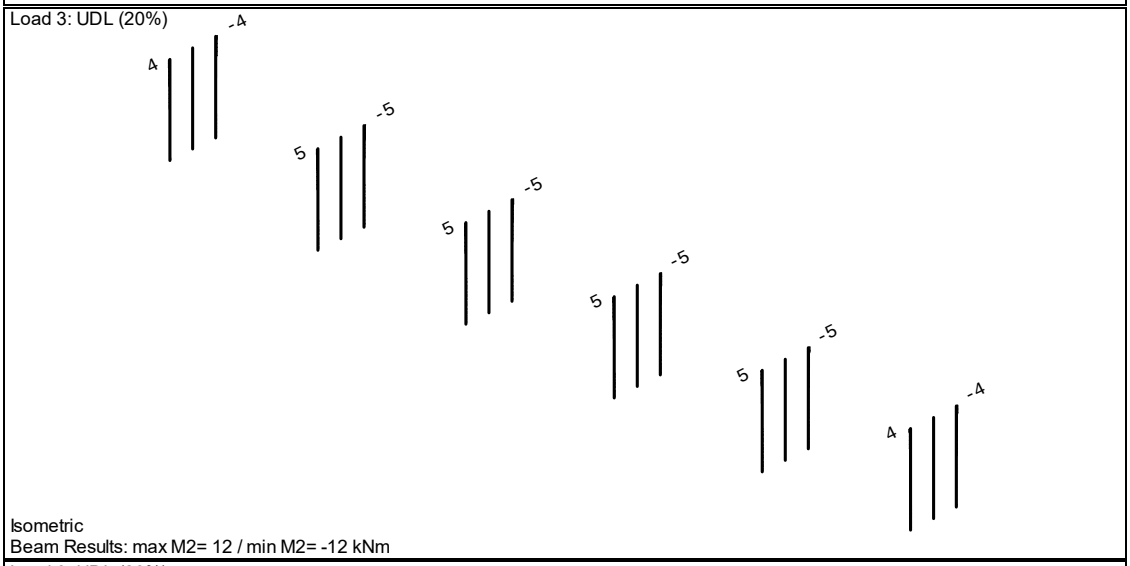
Isometric
Beam Results: max M1= 22 / min M1= -22 kNm

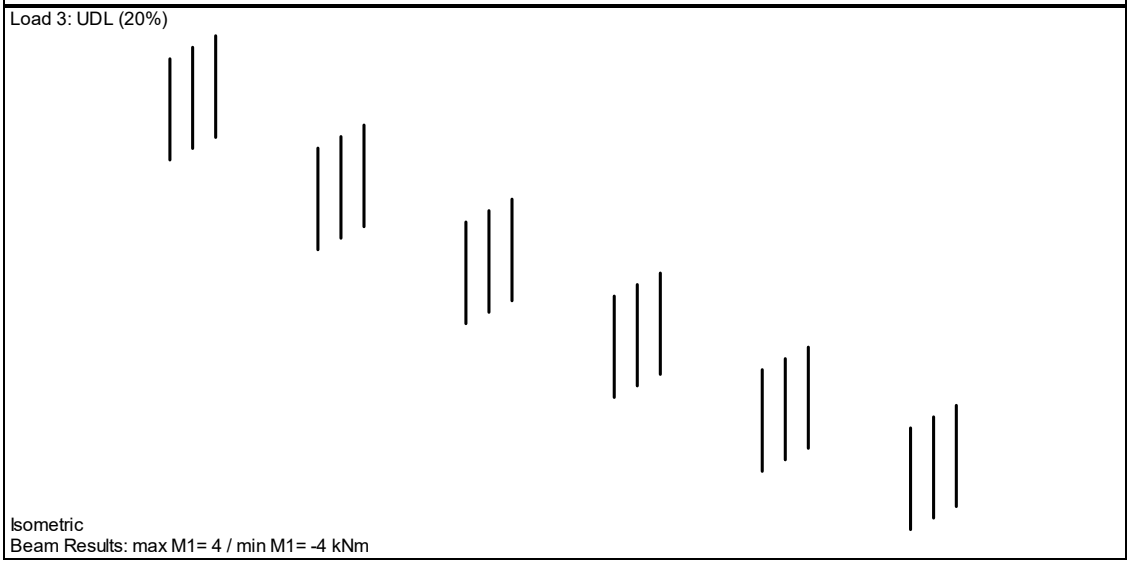

Load 2: Dodatno stalno
Isometric
Beam Results: max V3= 9 / min V3= -9 kN

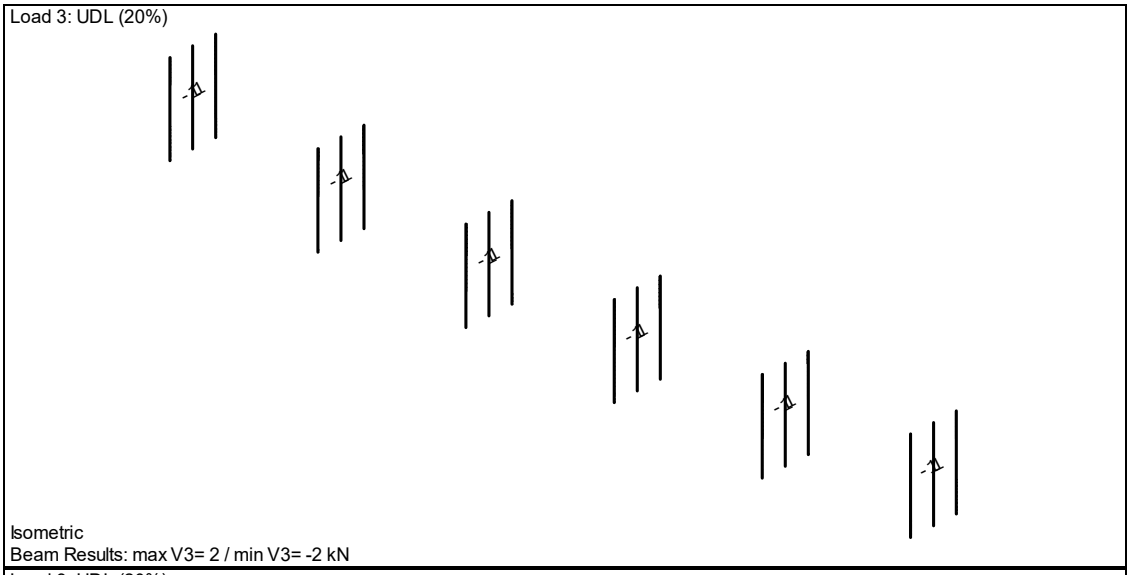

Load 2: Dodatno stalno
Isometric
Beam Results: max V2= 385 / min V2= -384 kN

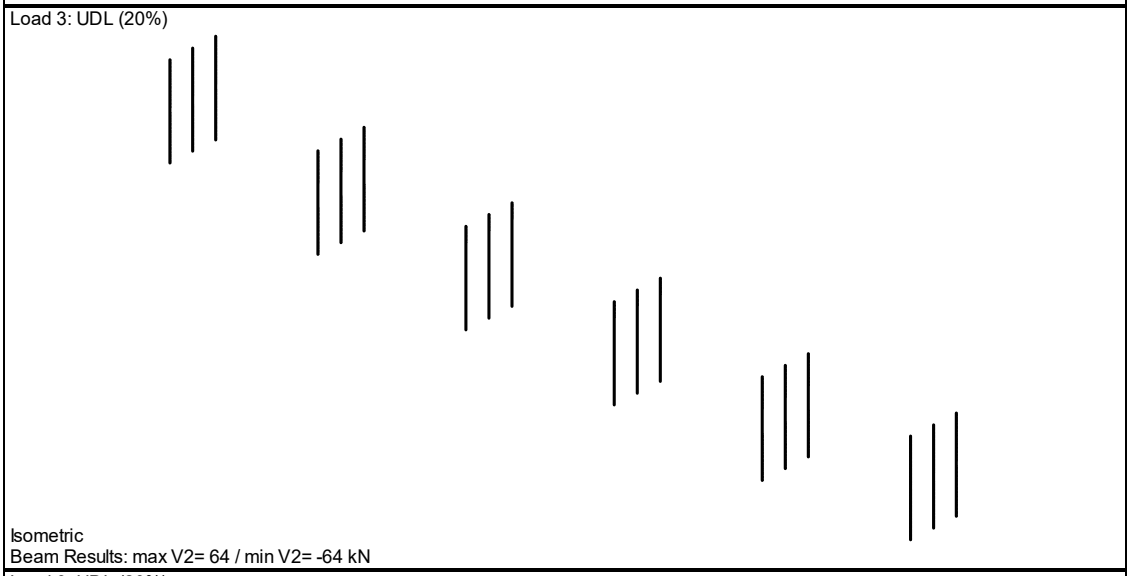

Load 2: Dodatno stalno
Isometric
Beam Results: max N1= 5 / min N1= -508 kN

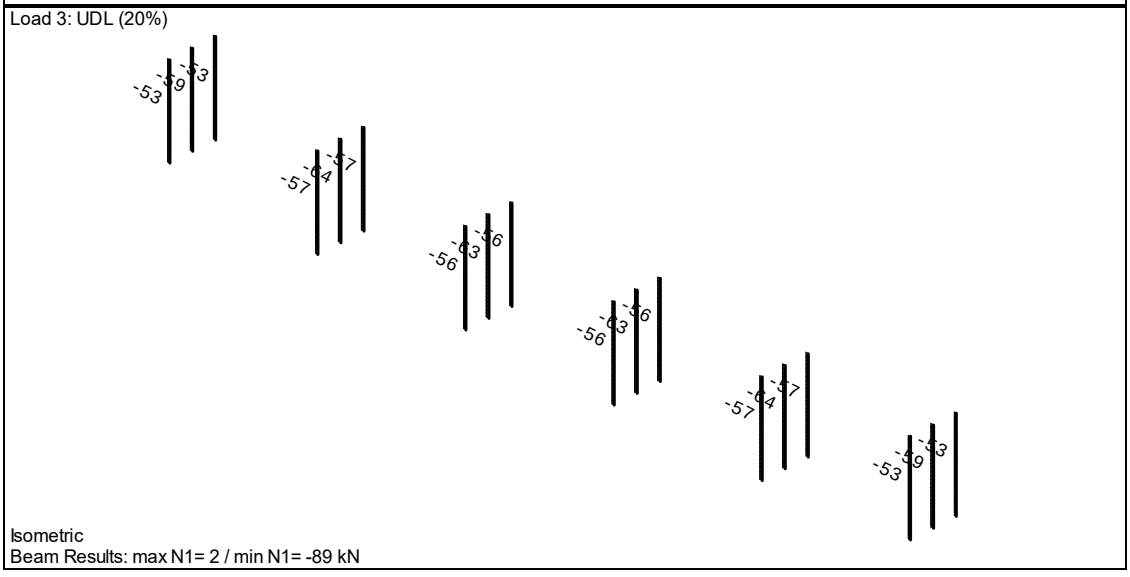

Load 3: UDL (20%)
Isometric
Beam Results: max M3= 84 / min M3= -14 kNm

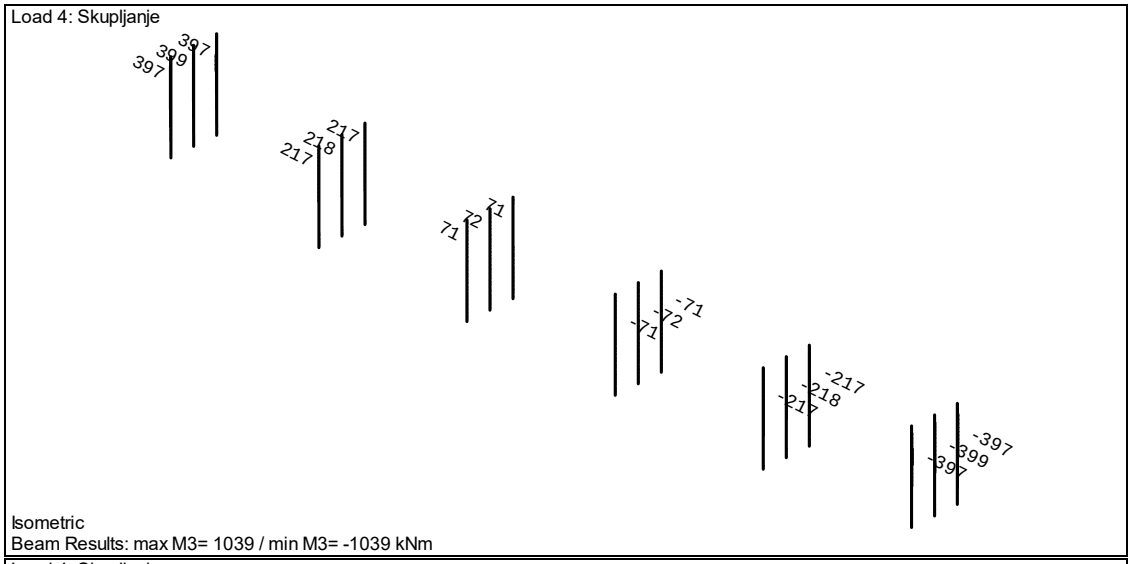

Load 3: UDL (20%)
Isometric
Beam Results: max M2= 12 / min M2= -12 kNm

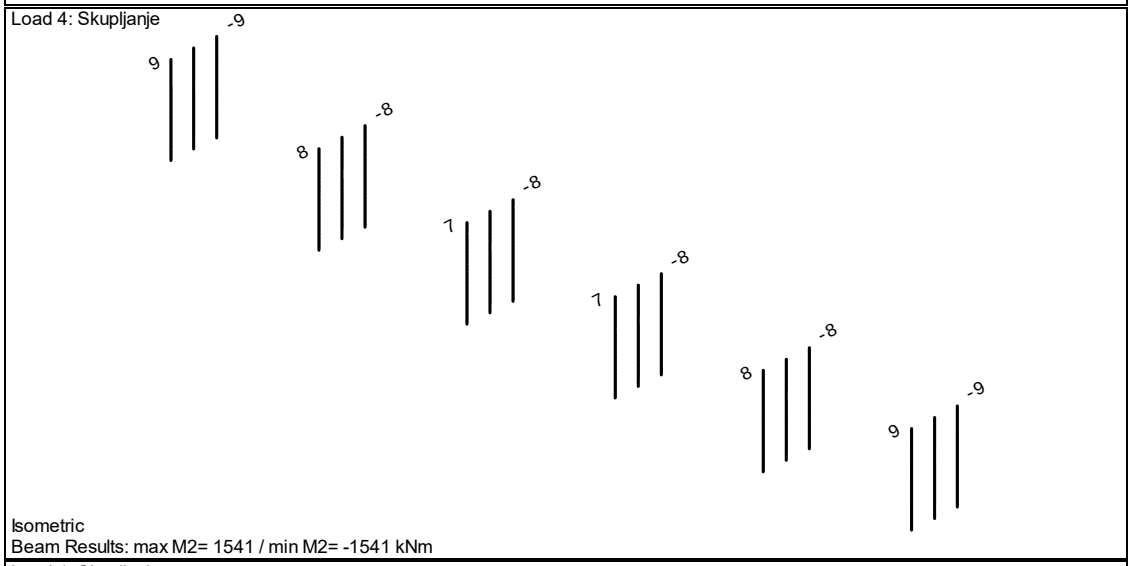

Load 3: UDL (20%)
Isometric
Beam Results: max M1= 4 / min M1= -4 kNm

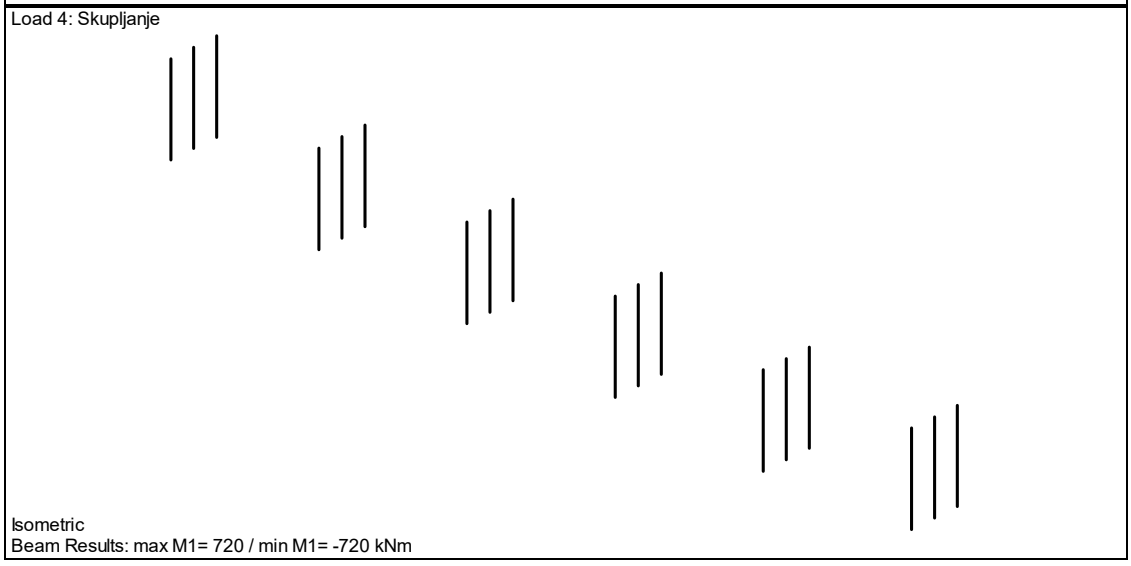

Load 3: UDL (20%)
Isometric
Beam Results: max V3= 2 / min V3= -2 kN


Load 3: UDL (20%)
Isometric
Beam Results: max V2= 64 / min V2= -64 kN

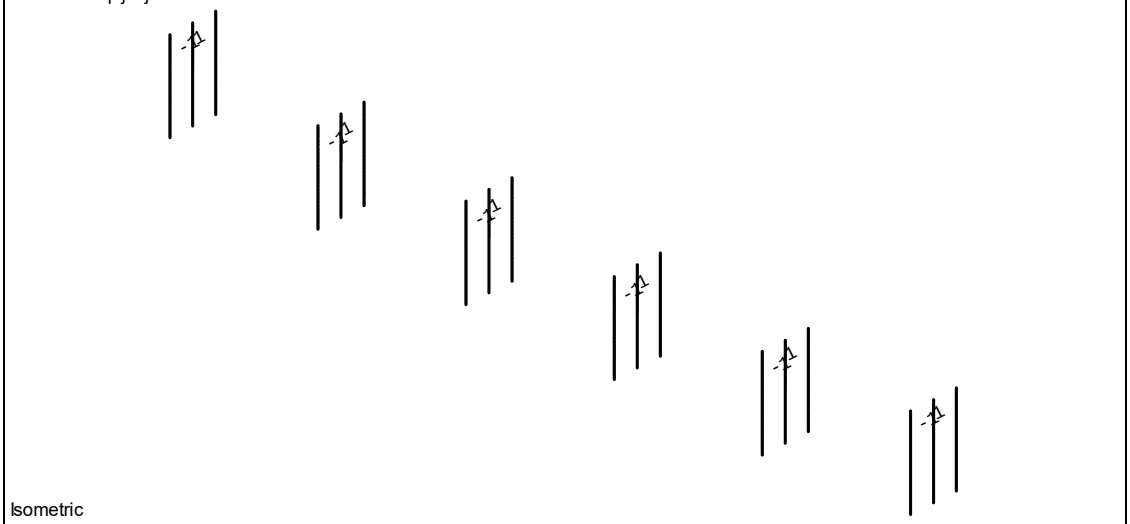

Load 3: UDL (20%)
Isometric
Beam Results: max N1= 2 / min N1= -89 kN


Load 4: Skupljanje
Isometric
Beam Results: max M3= 1039 / min M3= -1039 kNm


Load 4: Skupljanje
Isometric
Beam Results: max M2= 1541 / min M2= -1541 kNm

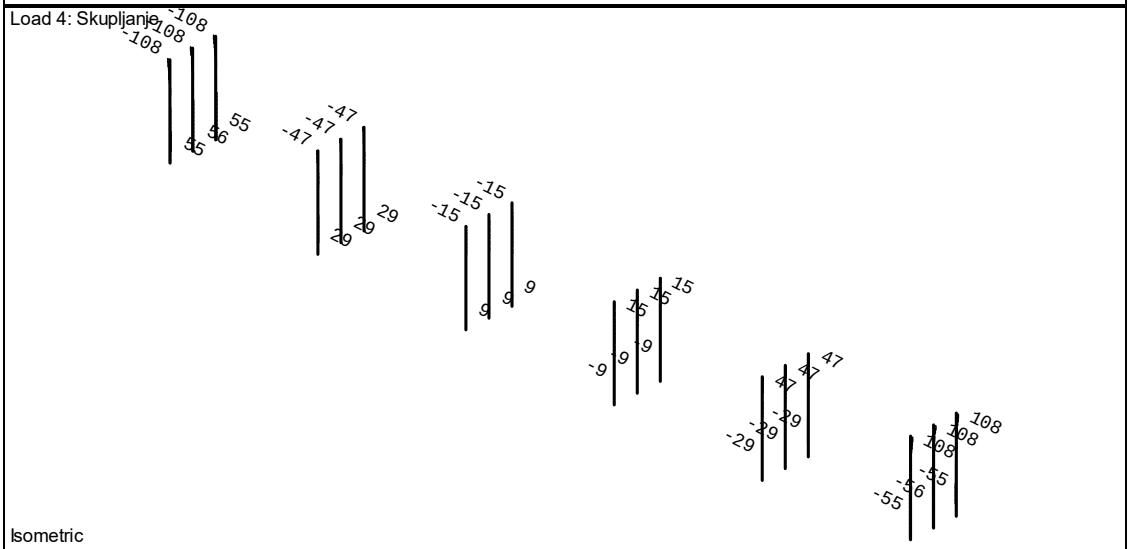

Load 4: Skupljanje
Isometric
Beam Results: max M1= 720 / min M1= -720 kNm

Load 4: Skupljanje



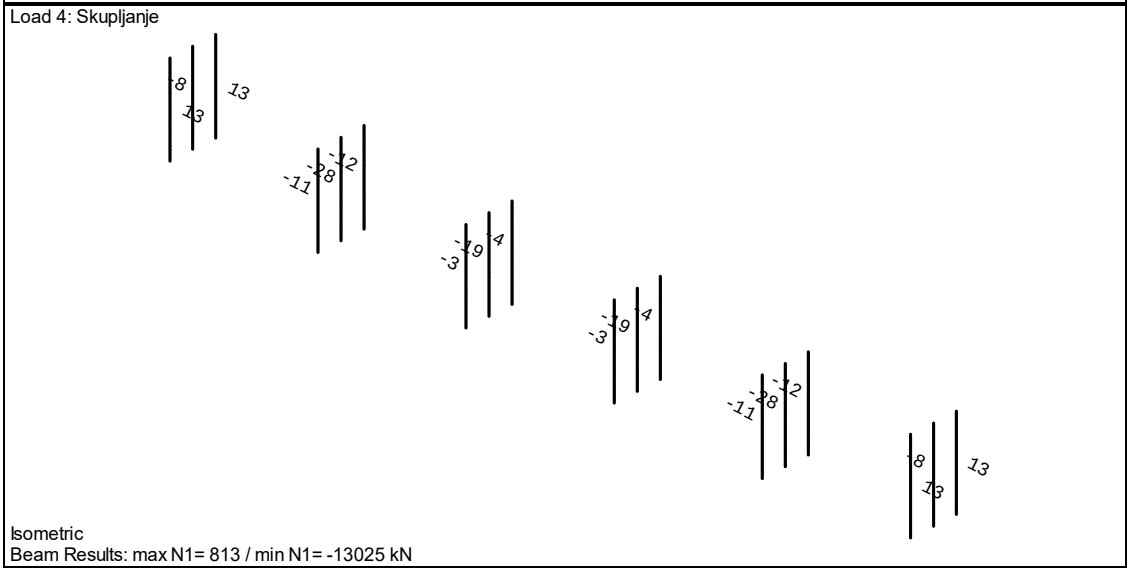
Isometric
Beam Results: max V3= 1001 / min V3= -1001 kN

Load 4: Skupljanje

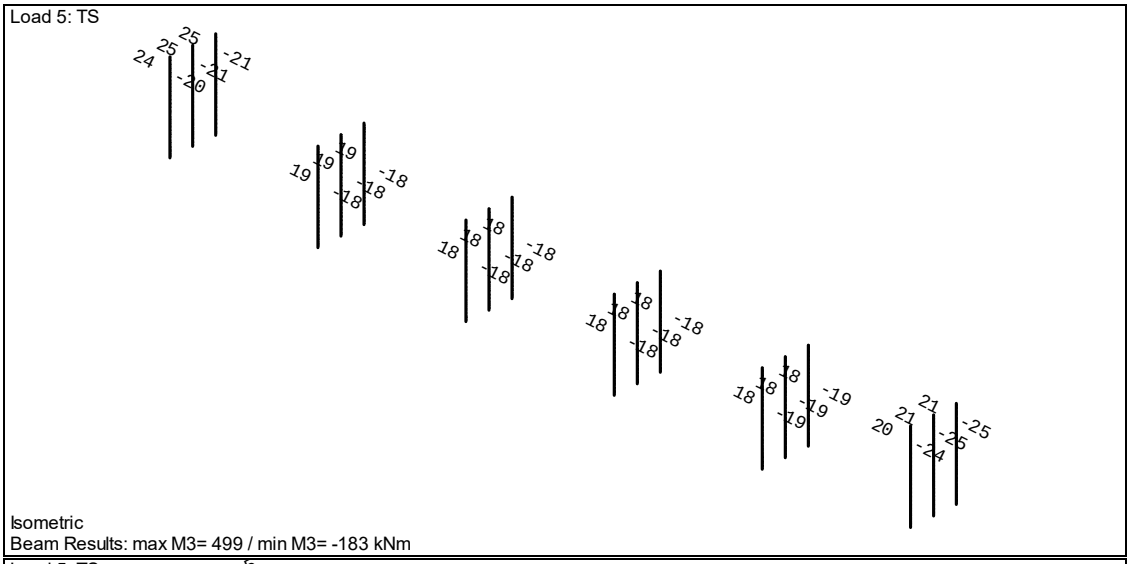


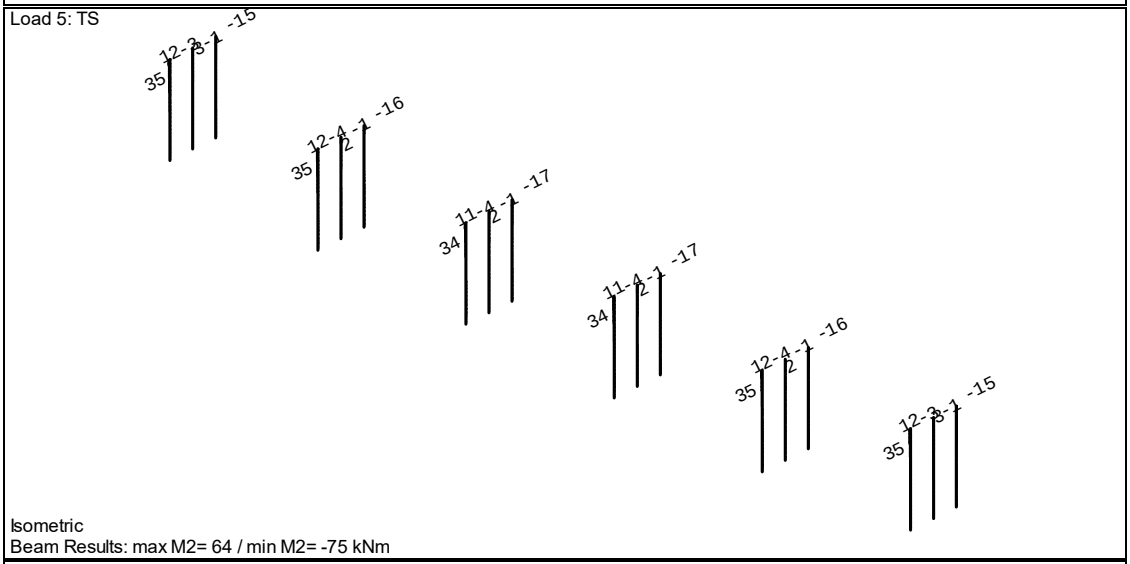
Isometric
Beam Results: max V2= 179 / min V2= -179 kN

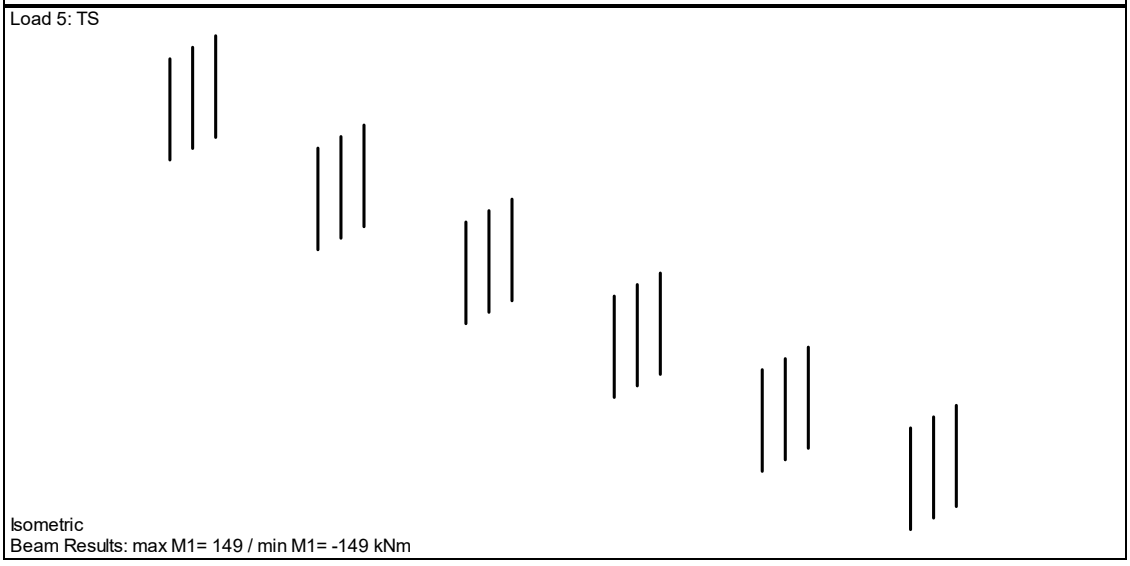
Load 4: Skupljanje

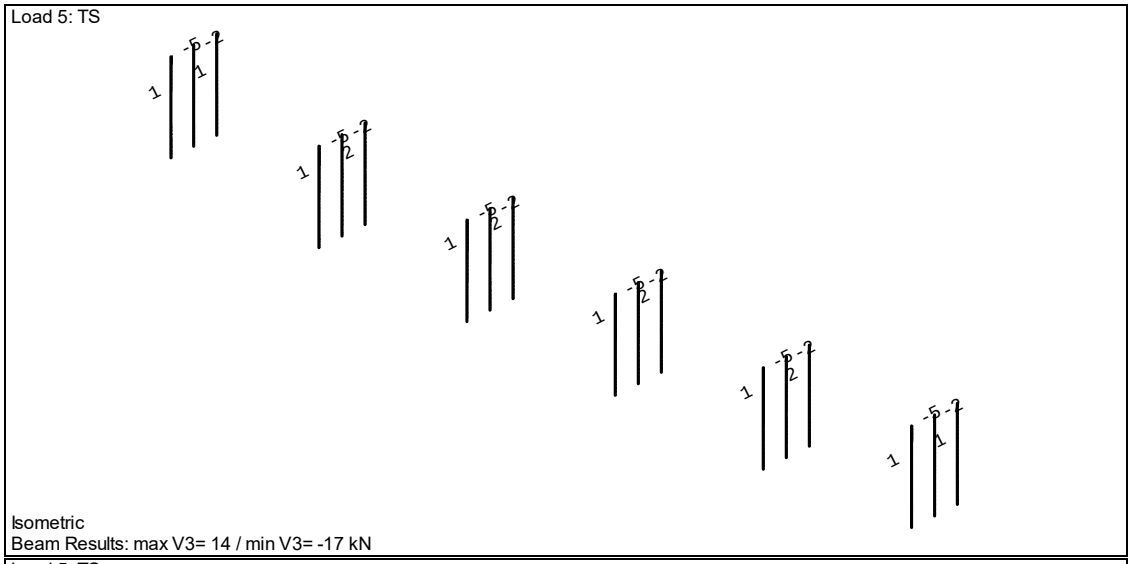


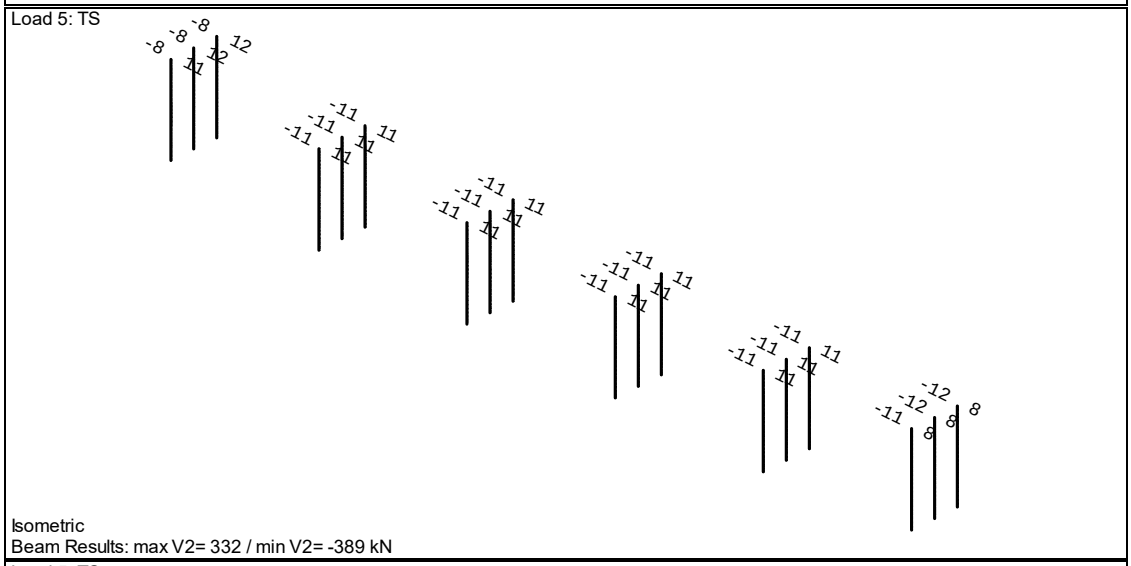
Isometric
Beam Results: max N1= 813 / min N1= -13025 kN

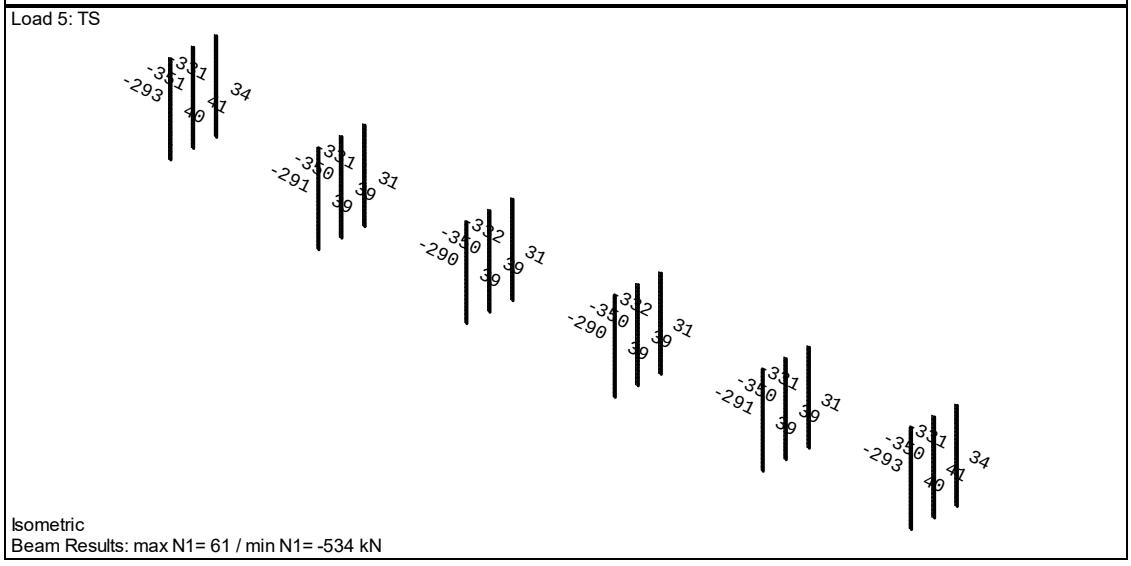

Load 5: TS
Isometric
Beam Results: max M3= 499 / min M3= -183 kNm

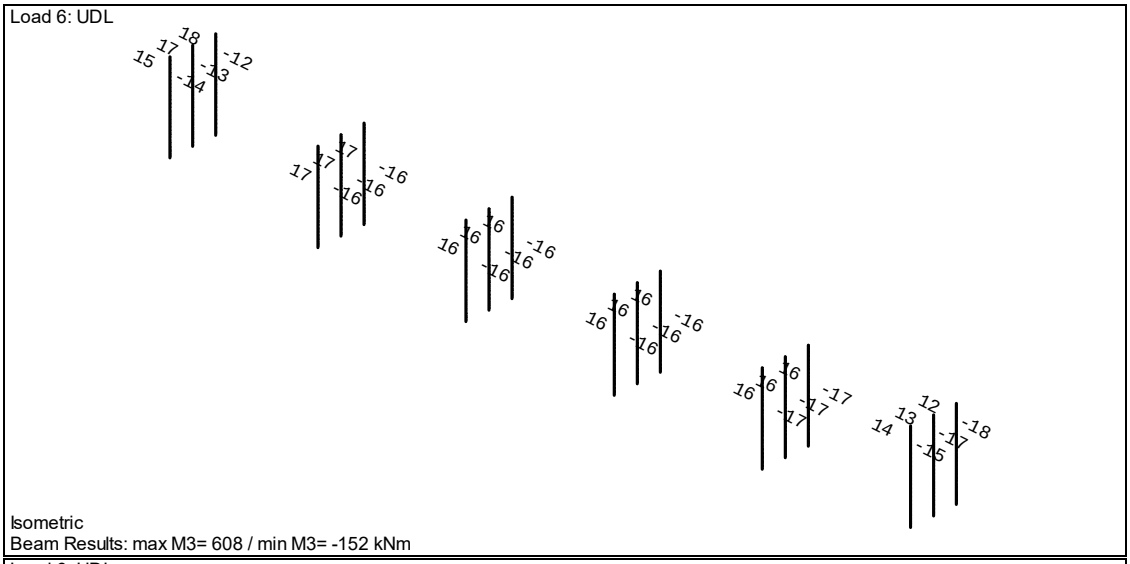

Load 5: TS
Isometric
Beam Results: max M2= 64 / min M2= -75 kNm

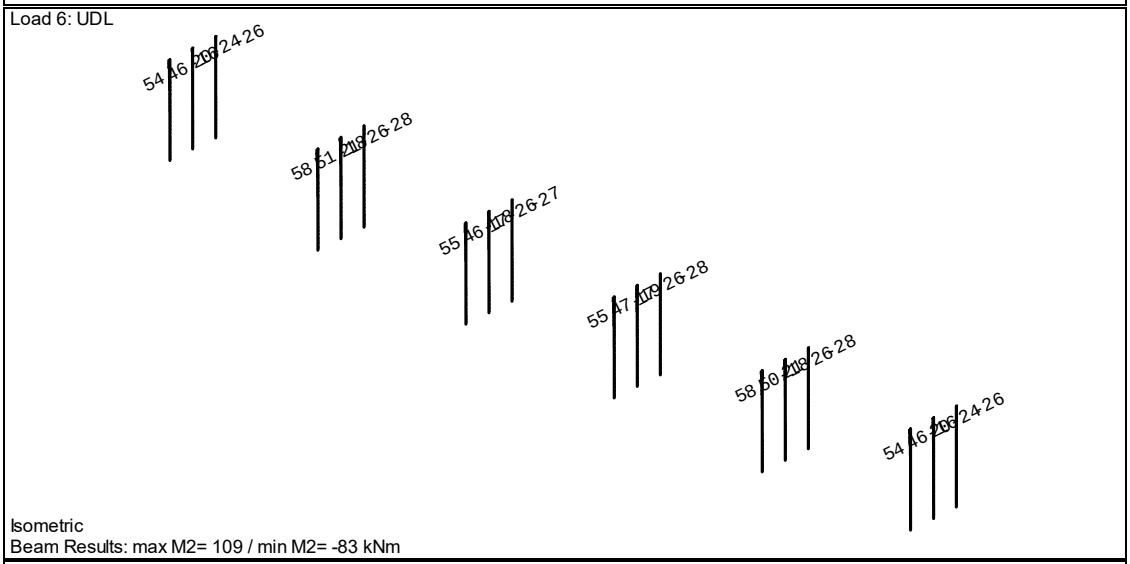

Load 5: TS
Isometric
Beam Results: max M1= 149 / min M1= -149 kNm

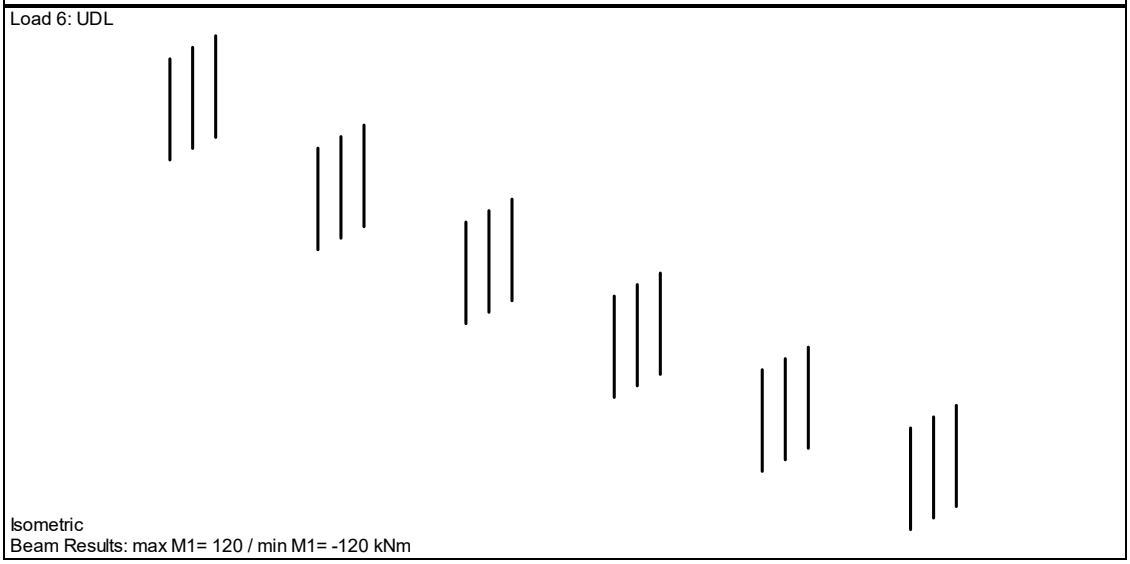

Load 5: TS
Isometric
Beam Results: max V3= 14 / min V3= -17 kN

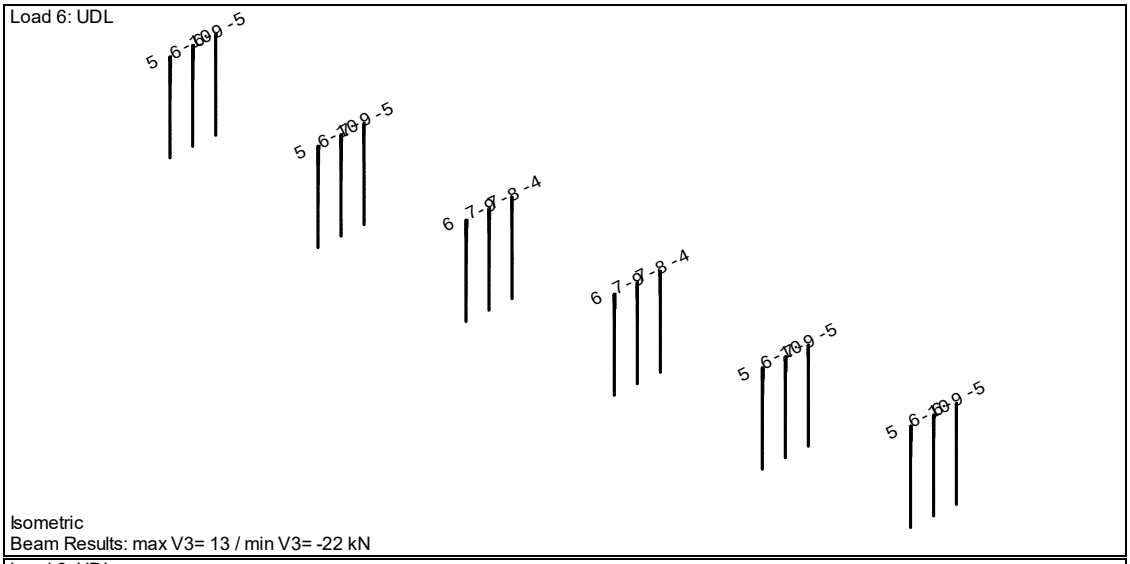

Load 5: TS
Isometric
Beam Results: max V2= 332 / min V2= -389 kN

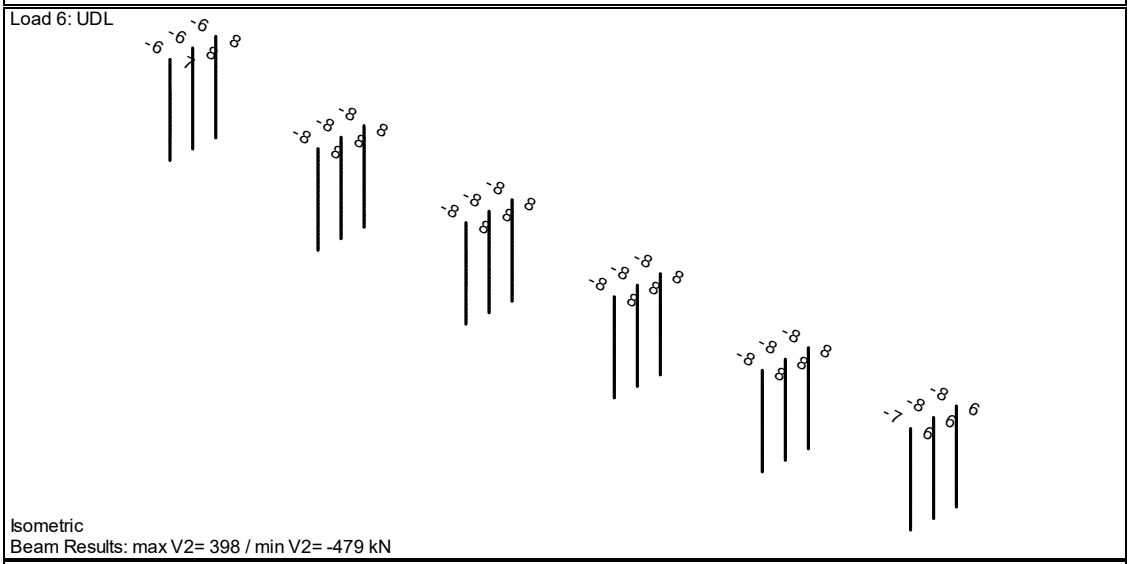

Load 5: TS
Isometric
Beam Results: max N1= 61 / min N1= -534 kN

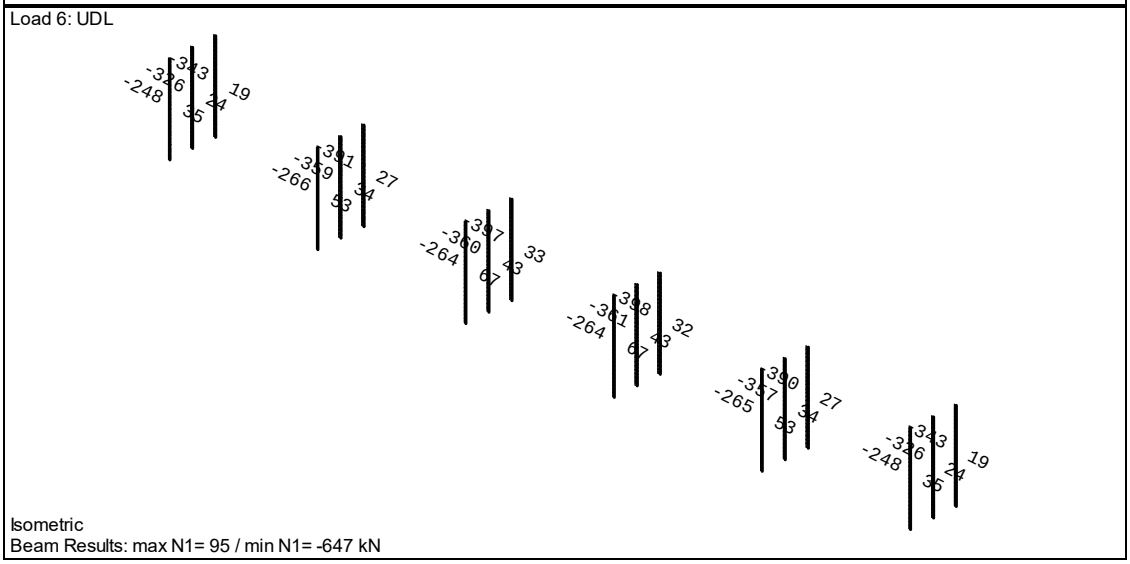

Load 6: UDL
Isometric
Beam Results: max M3= 608 / min M3= -152 kNm

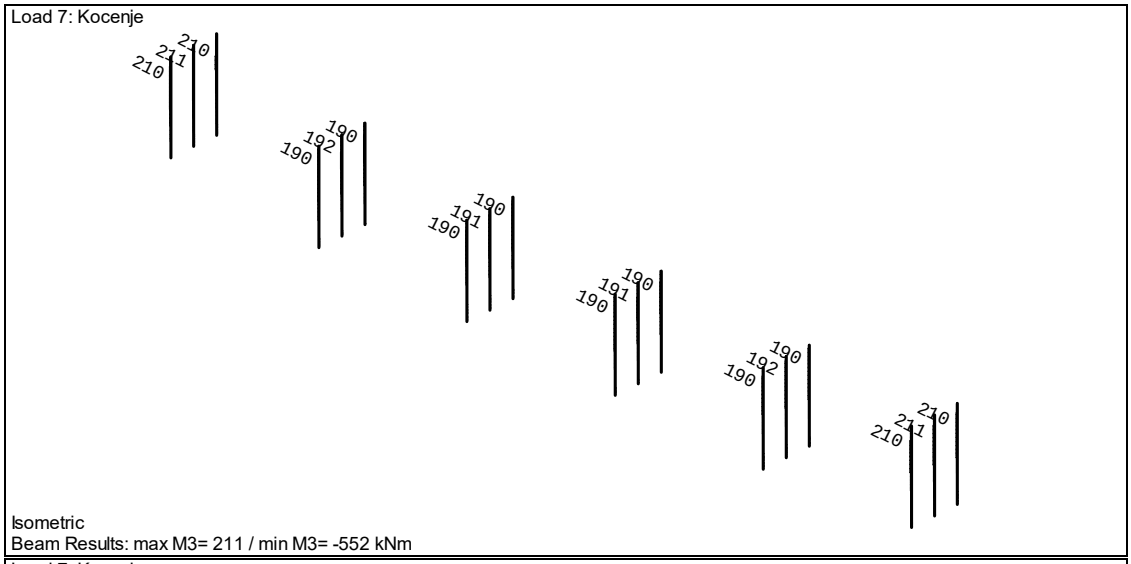

Load 6: UDL
Isometric
Beam Results: max M2= 109 / min M2= -83 kNm


Load 6: UDL
Isometric
Beam Results: max M1= 120 / min M1= -120 kNm


Load 6: UDL
Isometric
Beam Results: max V3= 13 / min V3= -22 kN


Load 6: UDL
Isometric
Beam Results: max V2= 398 / min V2= -479 kN


Load 6: UDL
Isometric
Beam Results: max N1= 95 / min N1= -647 kN


Load 7: Kocenje
210
211
210
190
192
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191
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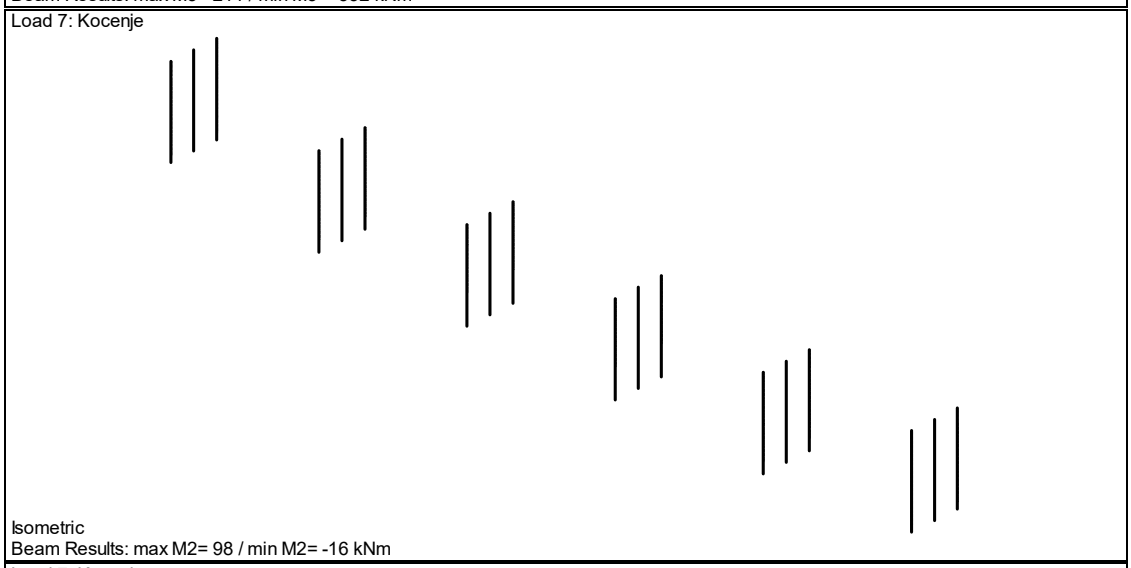
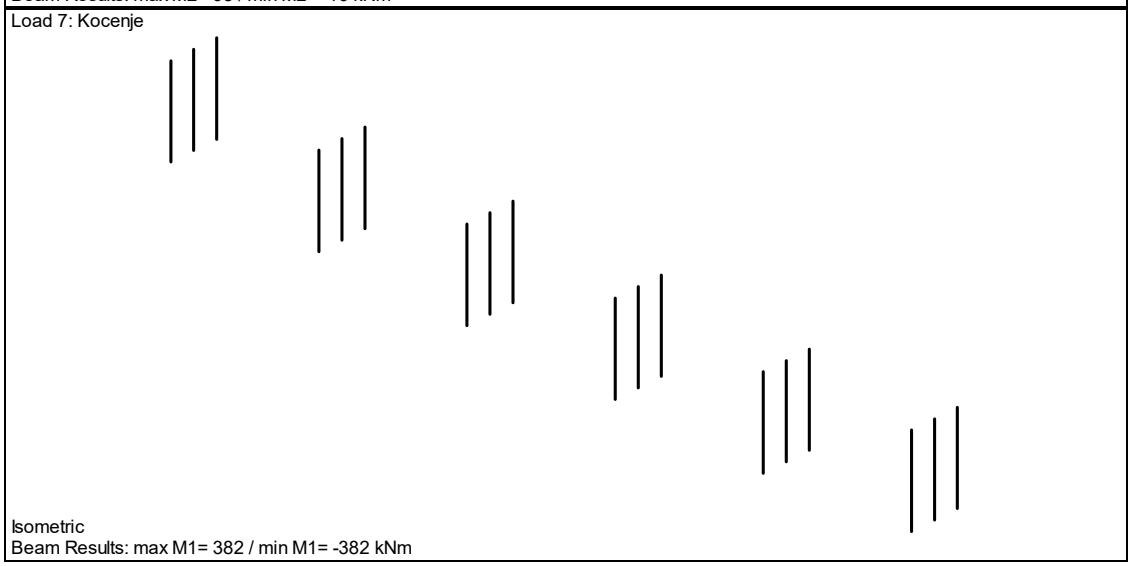
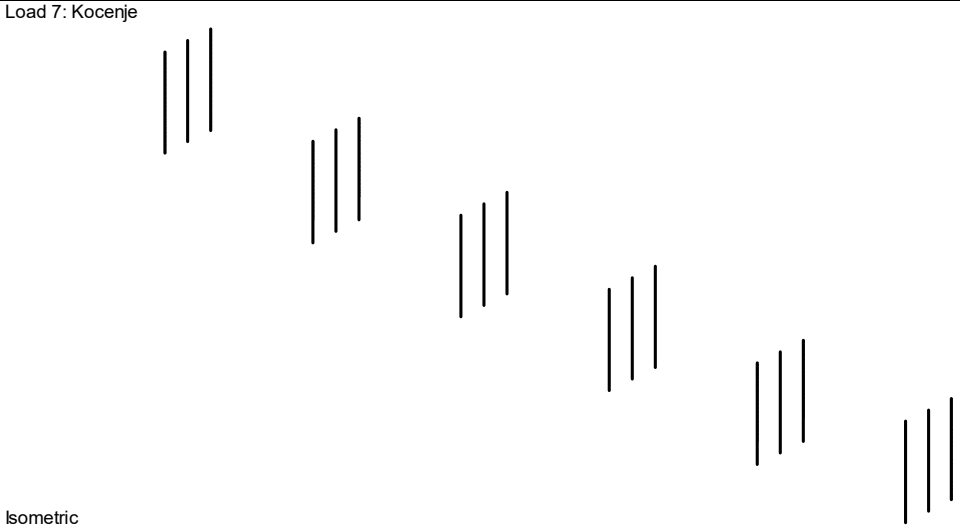
190
192
190
210
211
210
Isometric
Beam Results: max M3= 211 / min M3= -552 kNm


Load 7: Kocenje
Isometric
Beam Results: max M2= 98 / min M2= -16 kNm

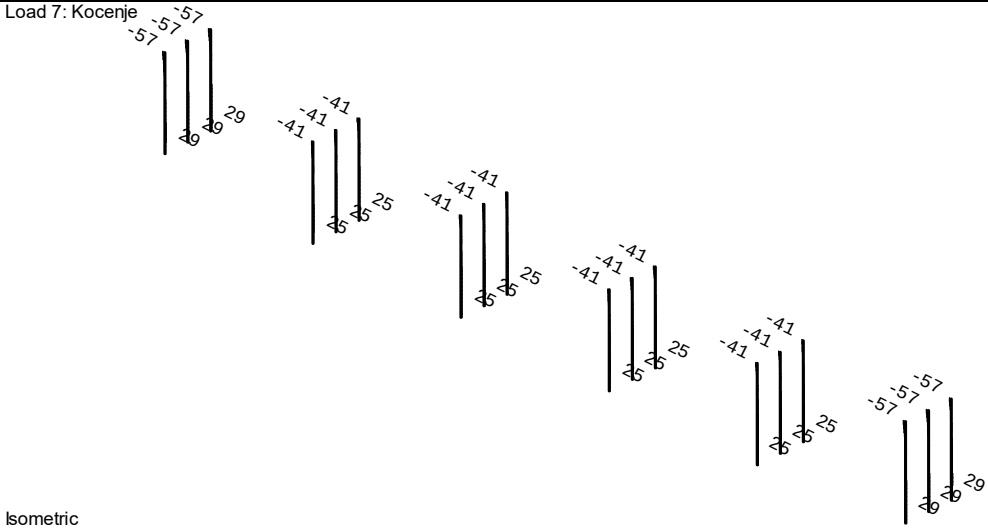

Load 7: Kocenje
Isometric
Beam Results: max M1= 382 / min M1= -382 kNm

Load 7: Kocenje



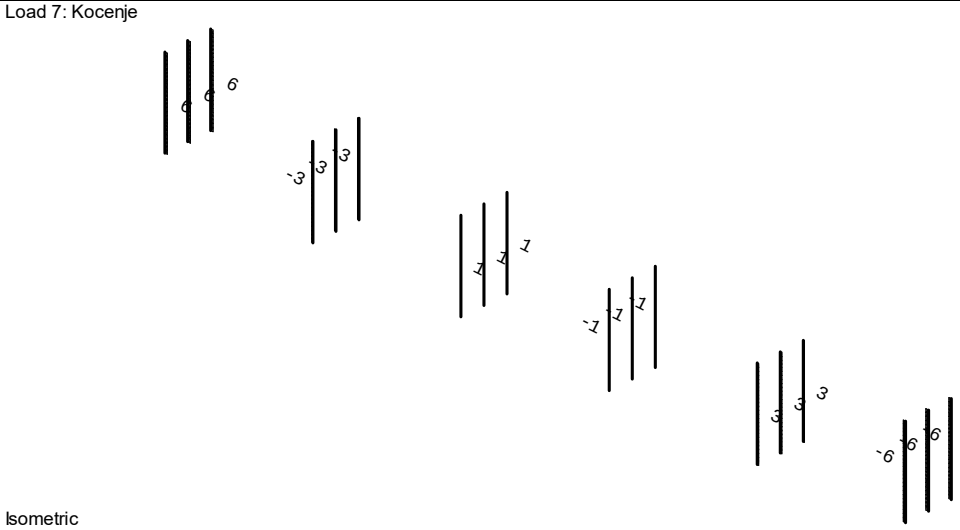
Isometric
Beam Results: max V3= 70 / min V3= -69 kN

Load 7: Kocenje

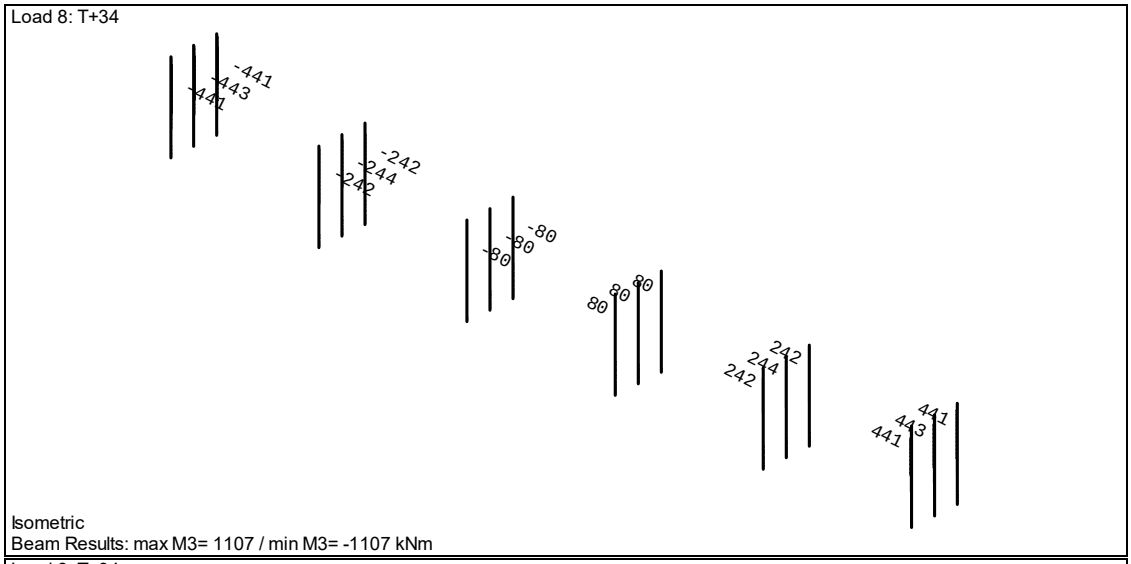


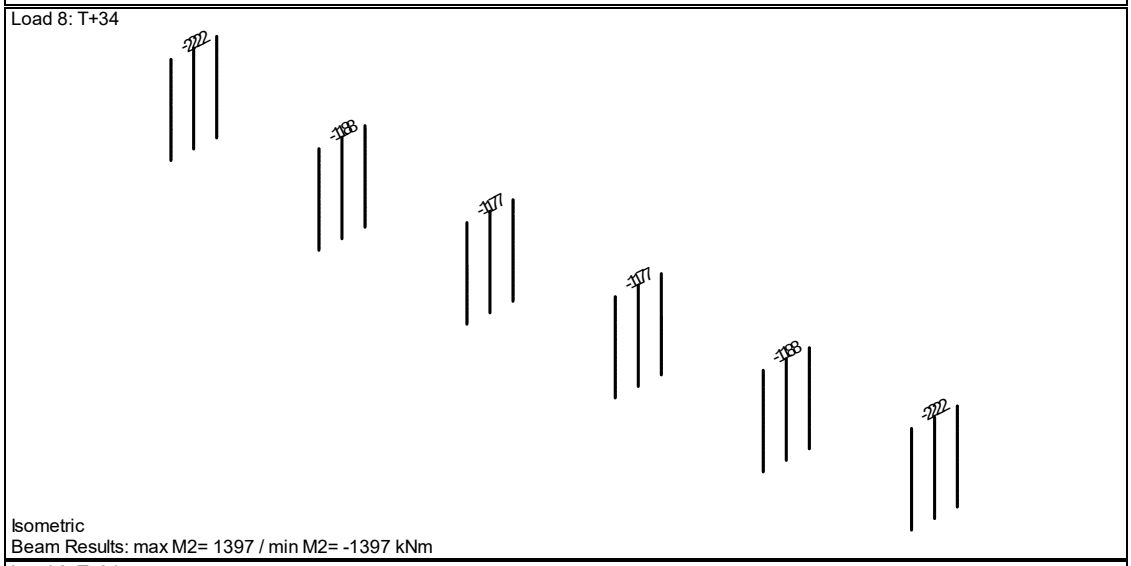
Isometric
Beam Results: max V2= 29 / min V2= -95 kN

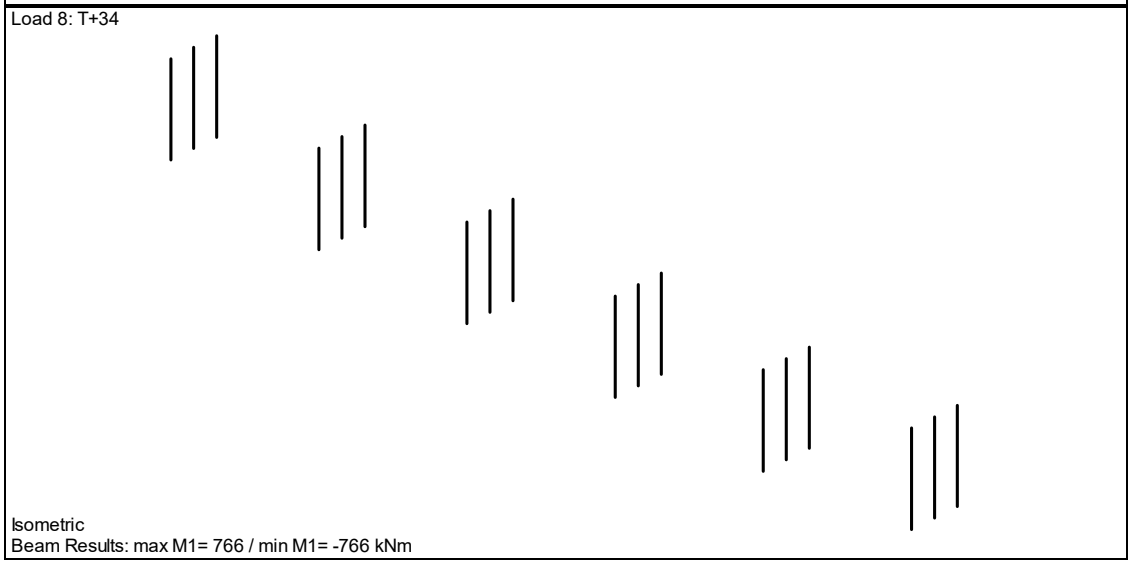
Load 7: Kocenje



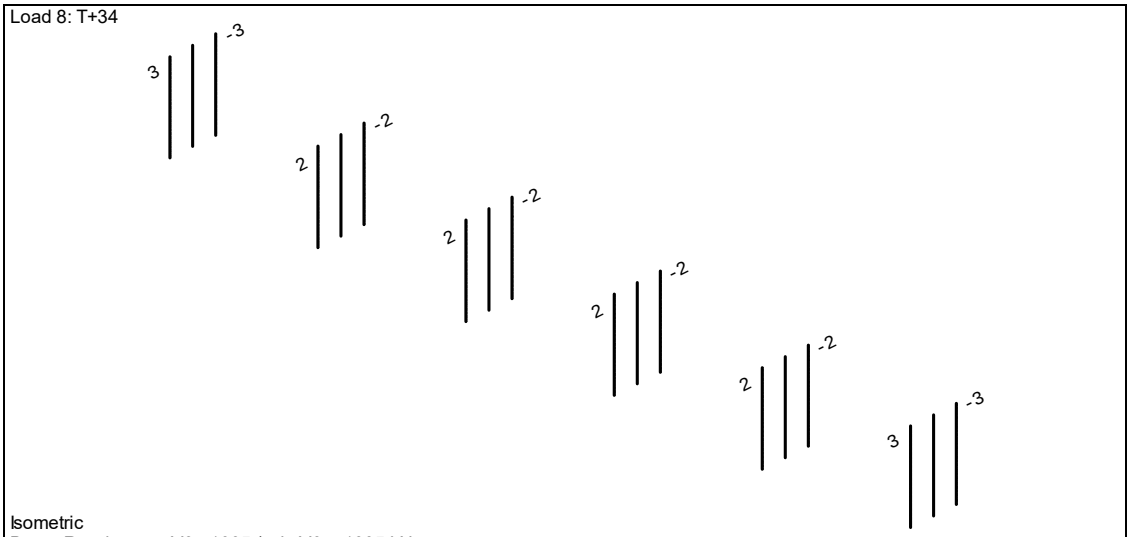
Isometric
Beam Results: max N1= 9 / min N1= -9 kN


Load 8: T+34
-441
-443
-441
-242
-244
-242
-80
-80
-80
80
80
80
242
244
242
441
443
441
Isometric
Beam Results: max M3= 1107 / min M3= -1107 kNm


Load 8: T+34
-222
-1188
-1107
-1107
-1188
-222
Isometric
Beam Results: max M2= 1397 / min M2= -1397 kNm

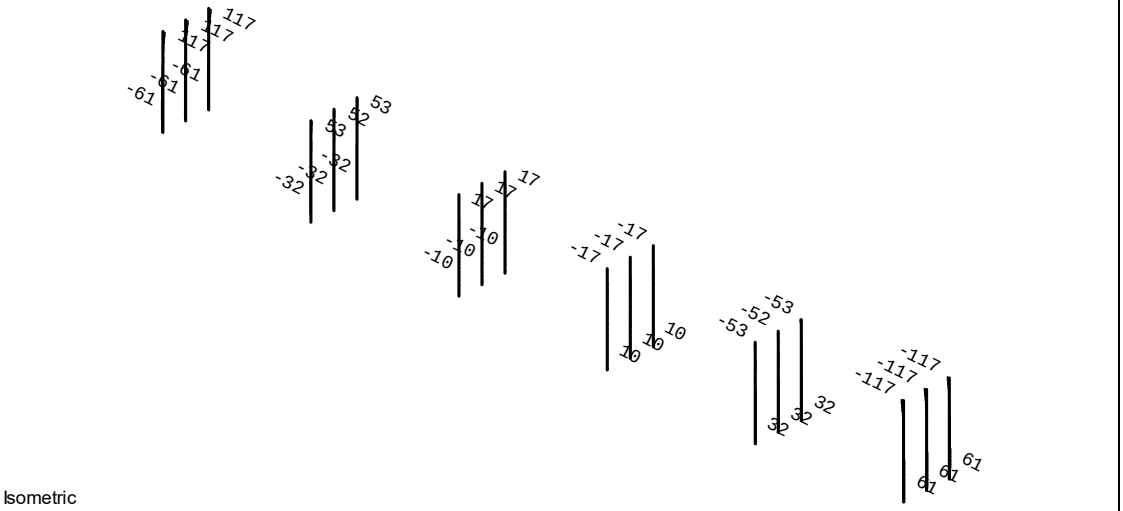

Load 8: T+34
Isometric
Beam Results: max M1= 766 / min M1= -766 kNm

Load 8: T+34



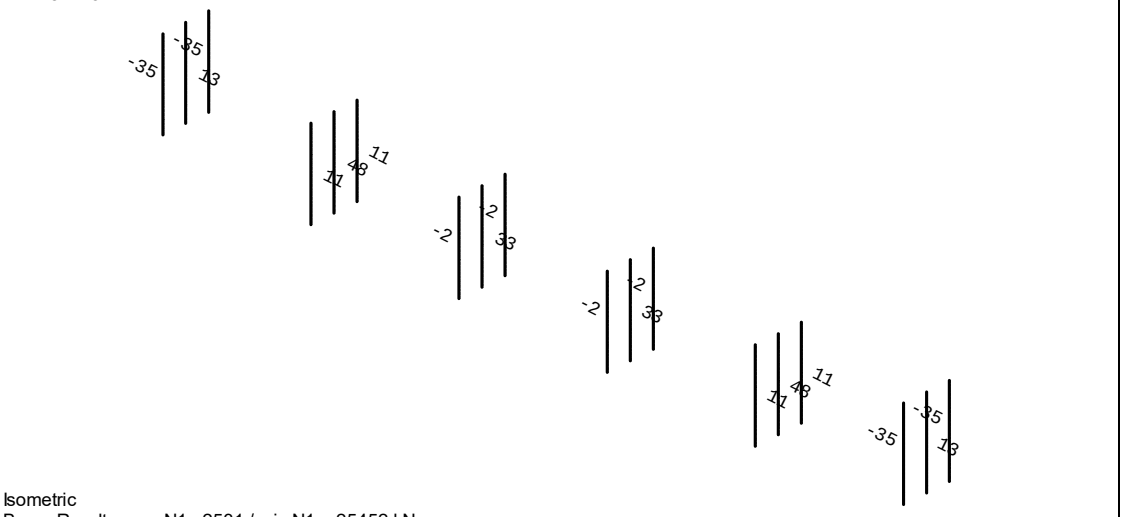
Isometric
Beam Results: max V3= 1005 / min V3= -1005 kN

Load 8: T+34

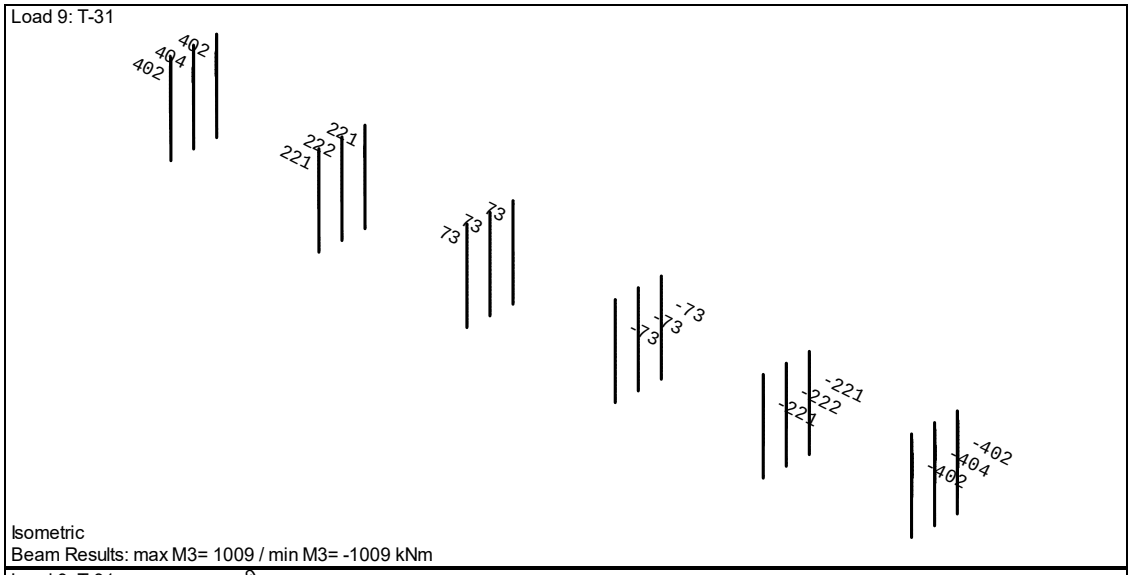


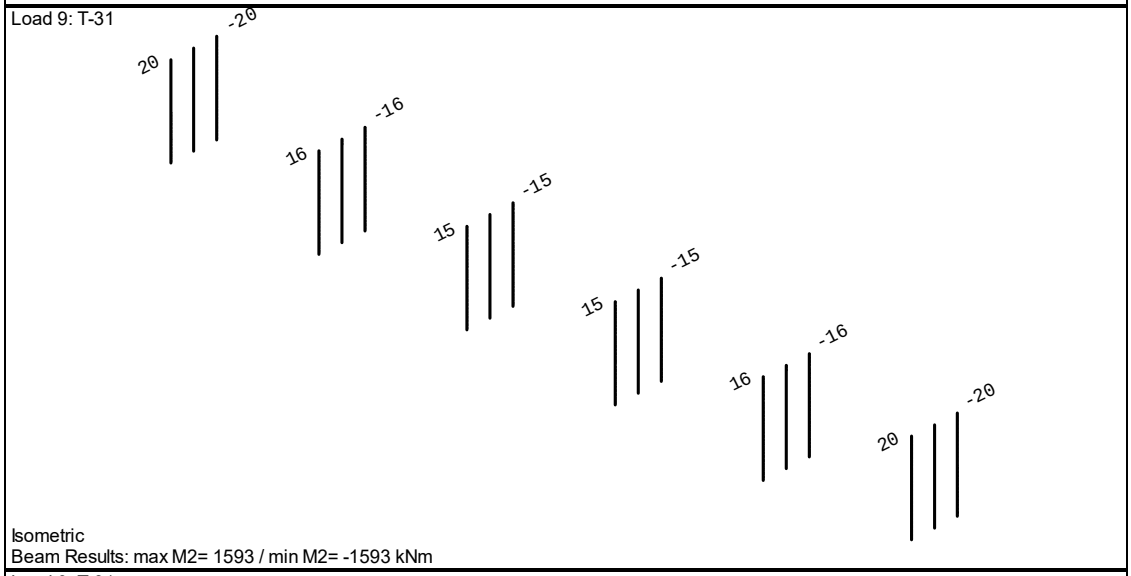
Isometric
Beam Results: max V2= 194 / min V2= -194 kN

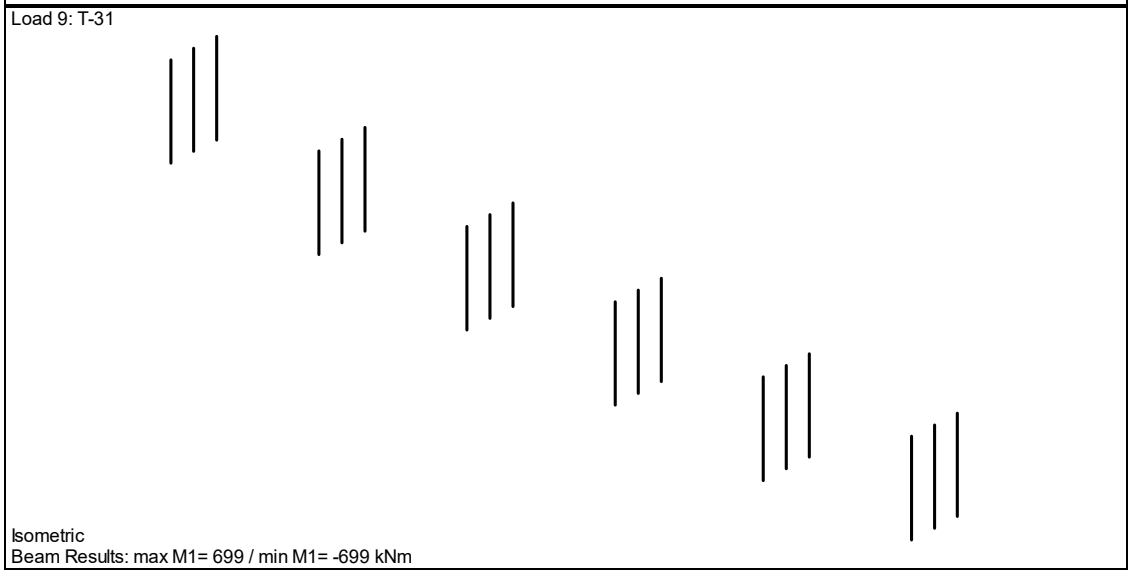
Load 8: T+34



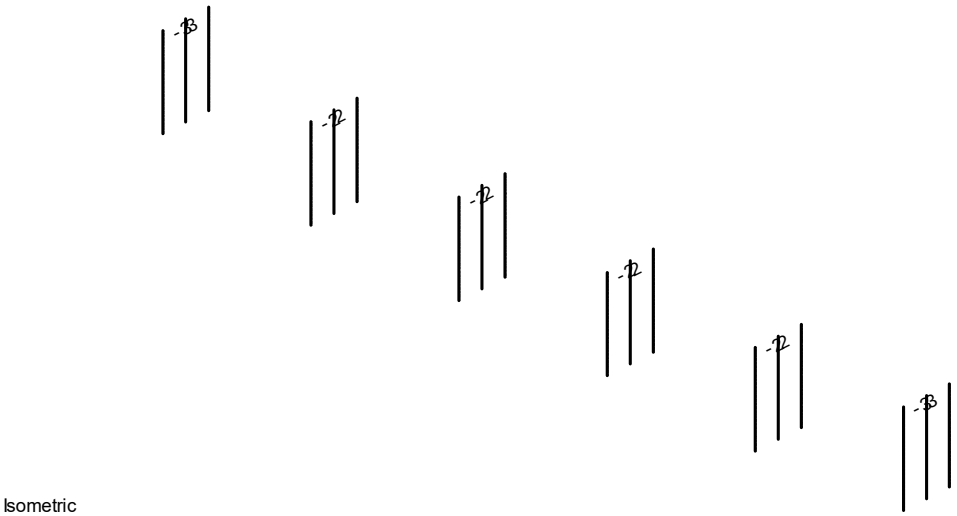
Isometric
Beam Results: max N1= 2531 / min N1= -25452 kN


Load 9: T-31
Isometric
Beam Results: max M3= 1009 / min M3= -1009 kNm


Load 9: T-31
Isometric
Beam Results: max M2= 1593 / min M2= -1593 kNm

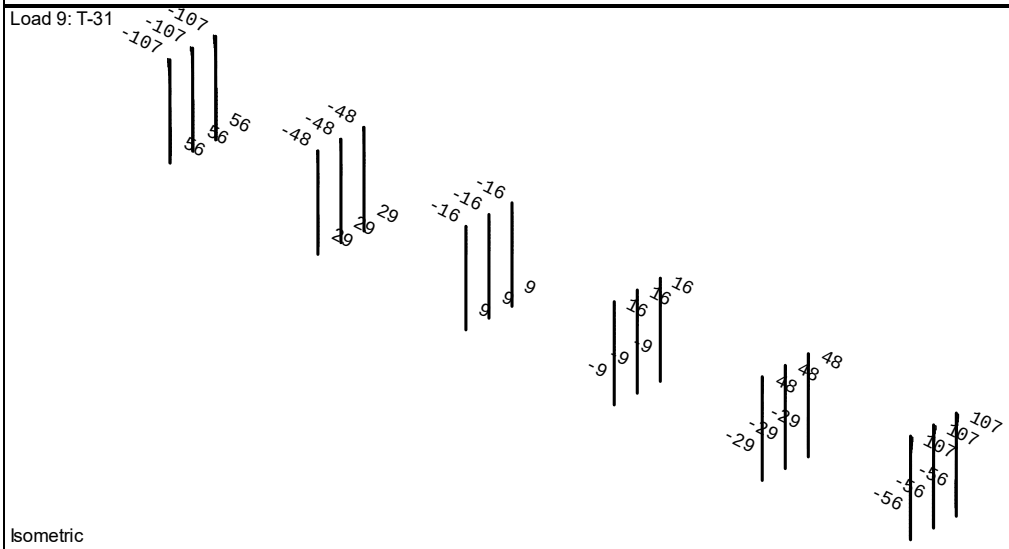

Load 9: T-31
Isometric
Beam Results: max M1= 699 / min M1= -699 kNm

Load 9: T-31



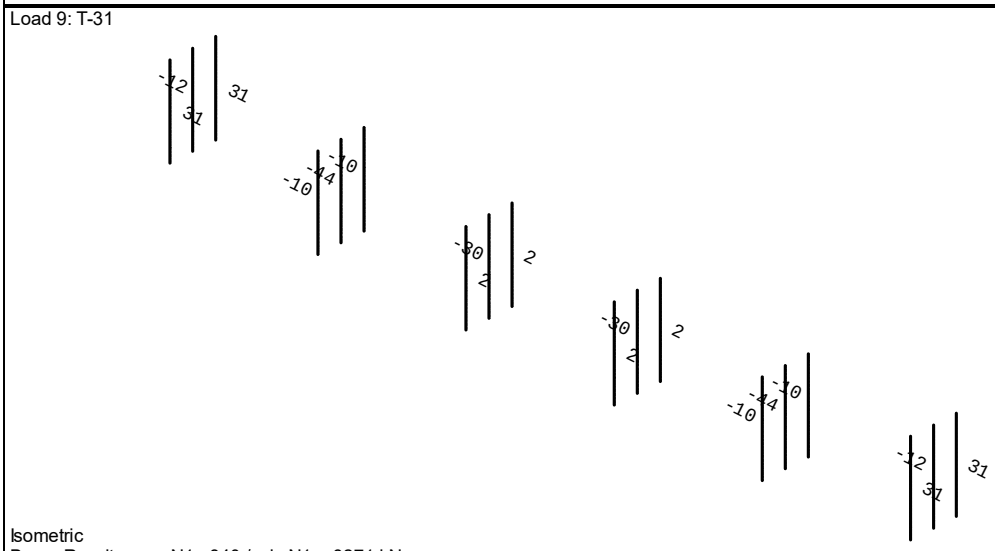
Isometric
Beam Results: max V3= 1035 / min V3= -1035 kN

Load 9: T-31

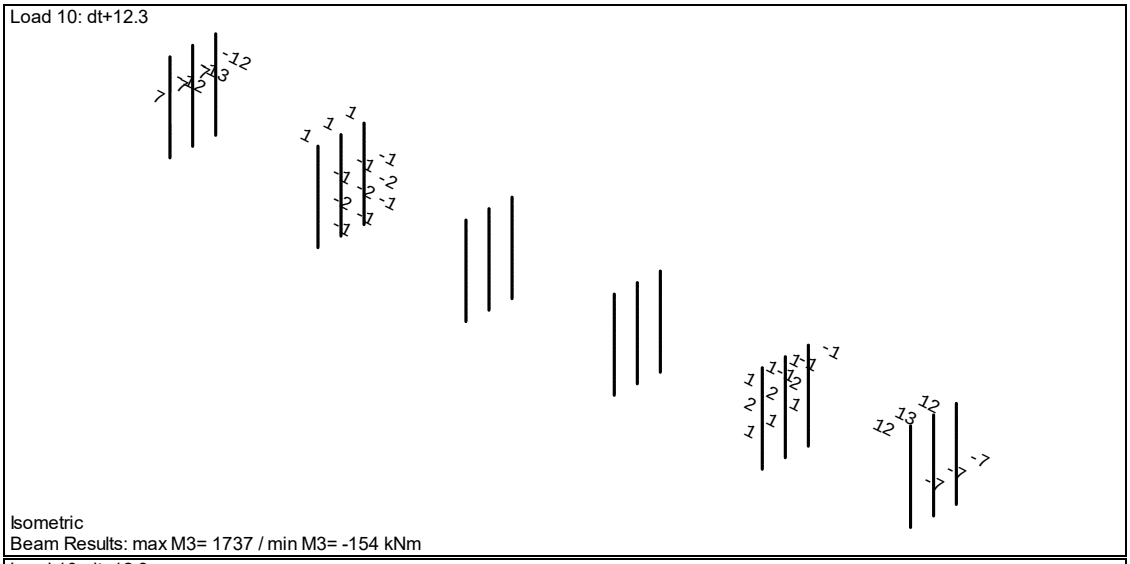


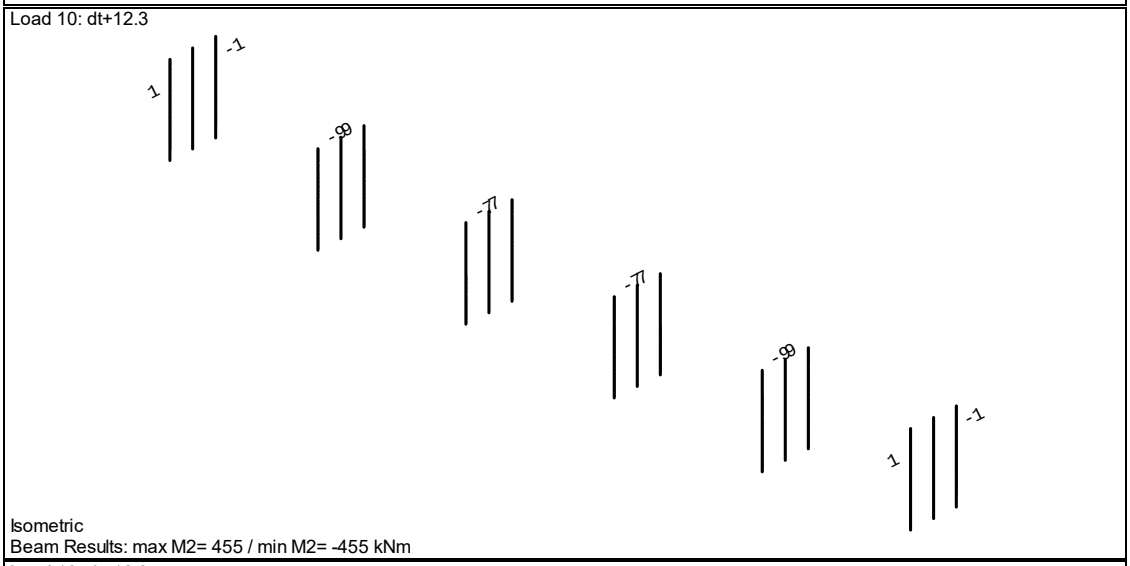
Isometric
Beam Results: max V2= 177 / min V2= -177 kN

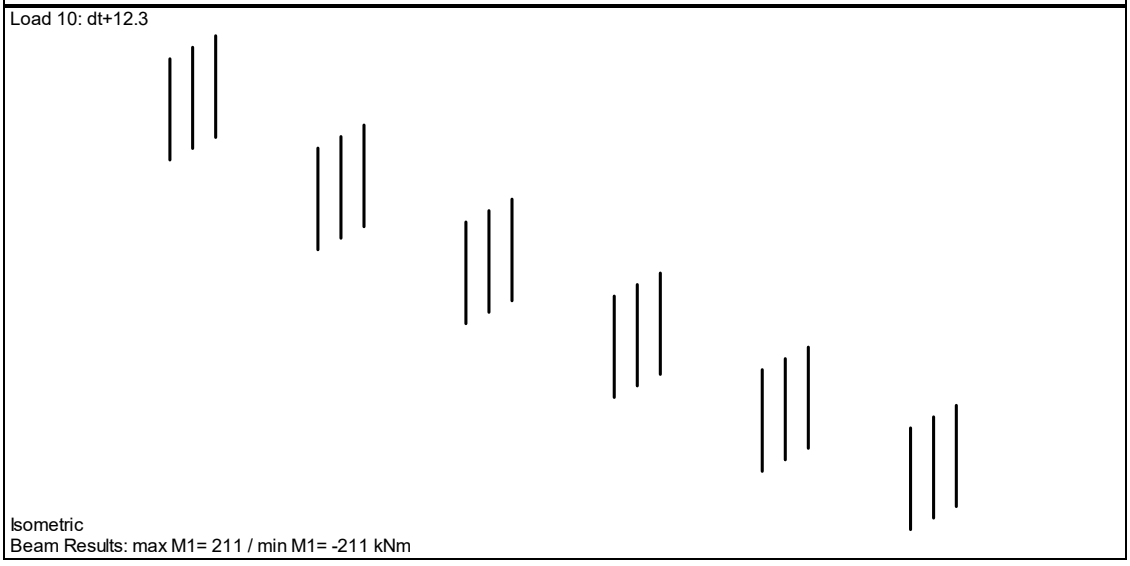
Load 9: T-31

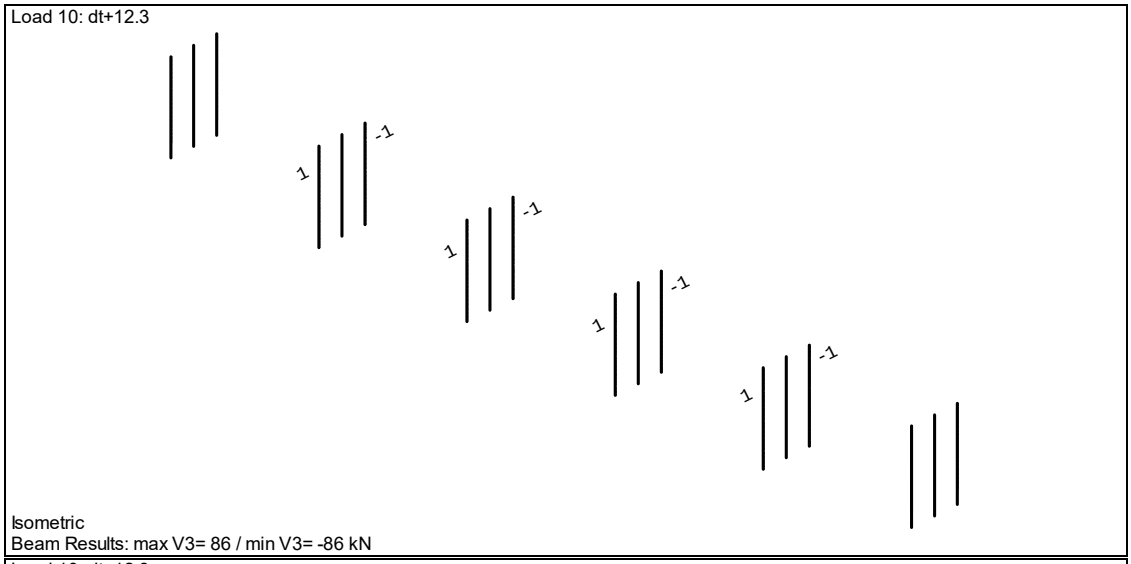


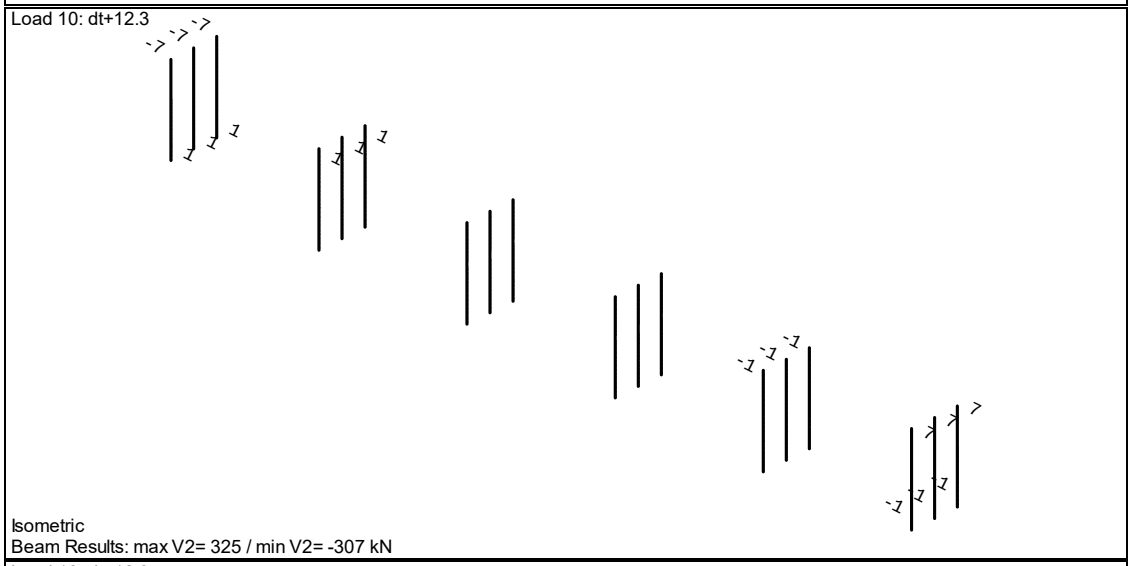
Isometric
Beam Results: max N1= 840 / min N1= -8271 kN

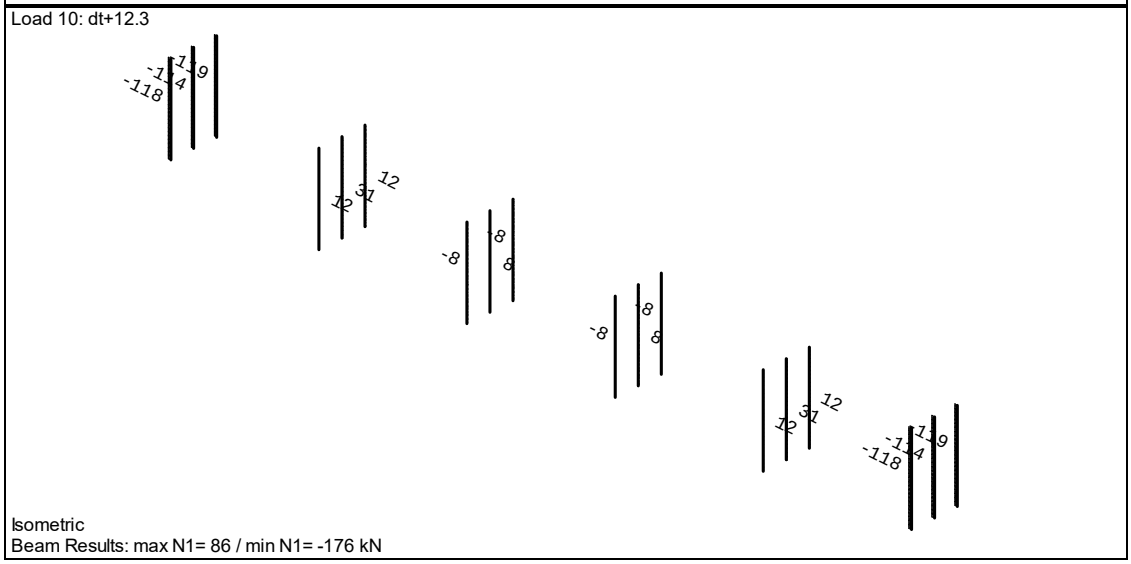

Load 10: dt+12.3
Isometric
Beam Results: max M3= 1737 / min M3= -154 kNm

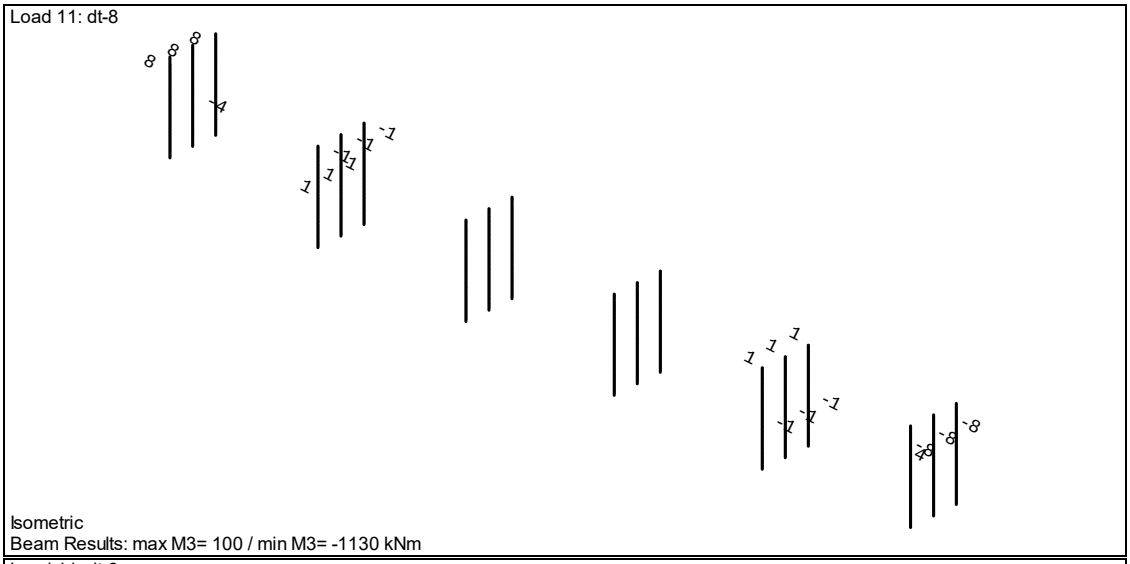

Load 10: dt+12.3
Isometric
Beam Results: max M2= 455 / min M2= -455 kNm

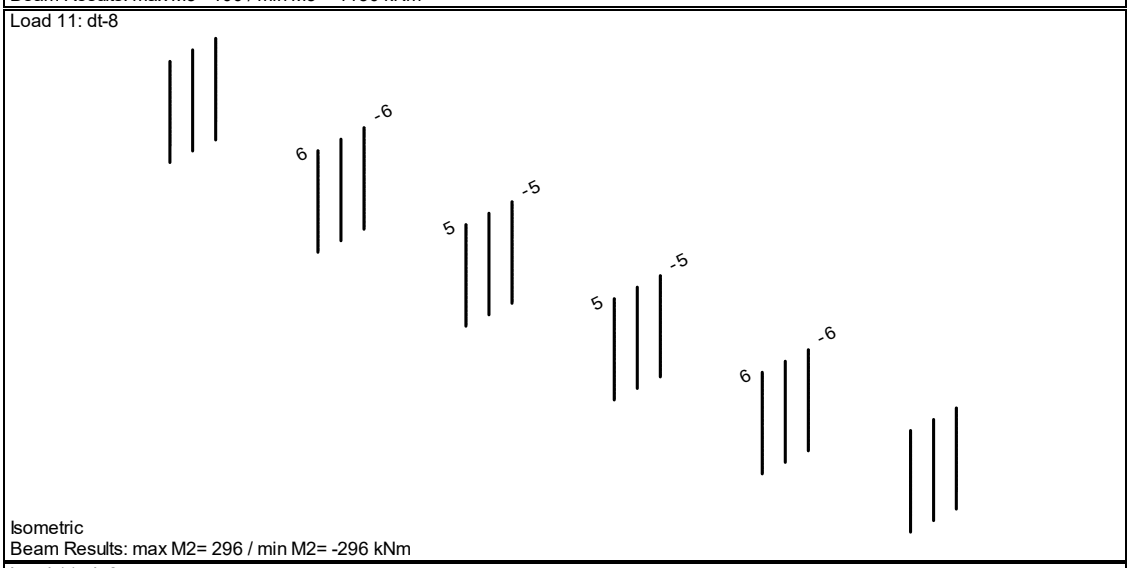

Load 10: dt+12.3
Isometric
Beam Results: max M1= 211 / min M1= -211 kNm

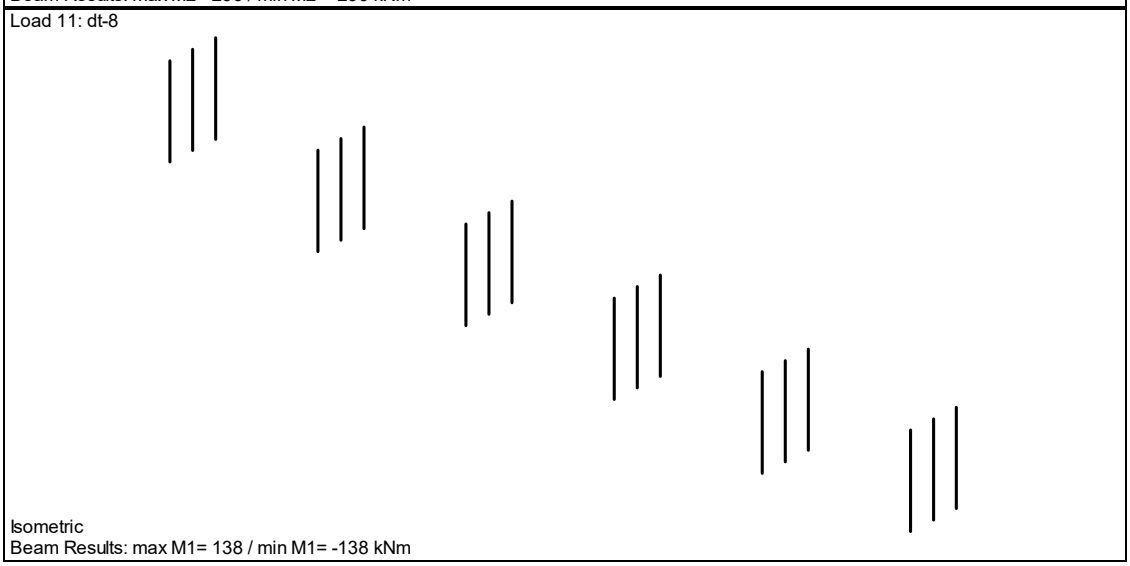

Load 10: dt+12.3
Isometric
Beam Results: max V3= 86 / min V3= -86 kN


Load 10: dt+12.3
Isometric
Beam Results: max V2= 325 / min V2= -307 kN

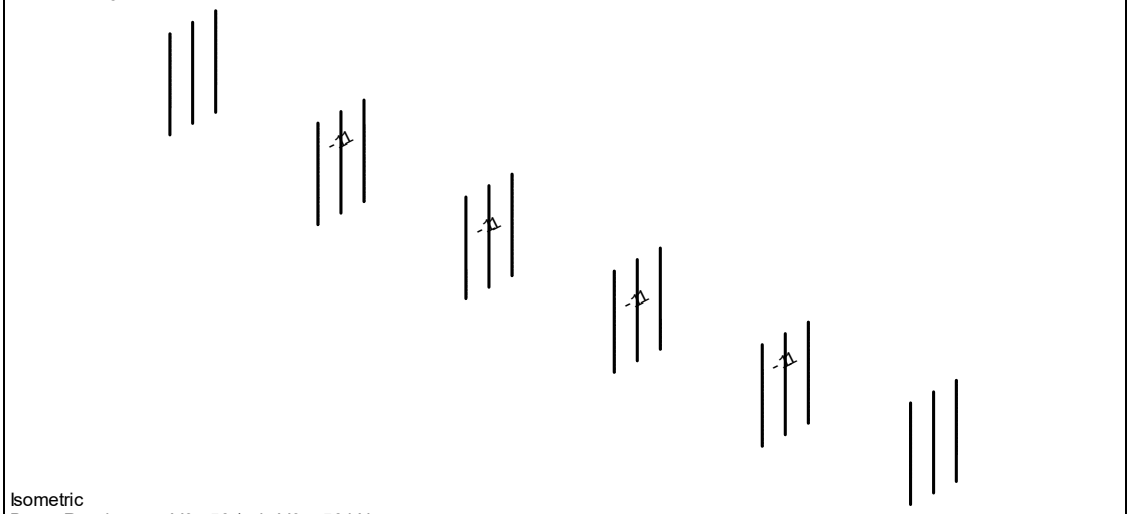

Load 10: dt+12.3
Isometric
Beam Results: max N1= 86 / min N1= -176 kN


Load 11: dt-8
Isometric
Beam Results: max M3= 100 / min M3= -1130 kNm


Load 11: dt-8
Isometric
Beam Results: max M2= 296 / min M2= -296 kNm

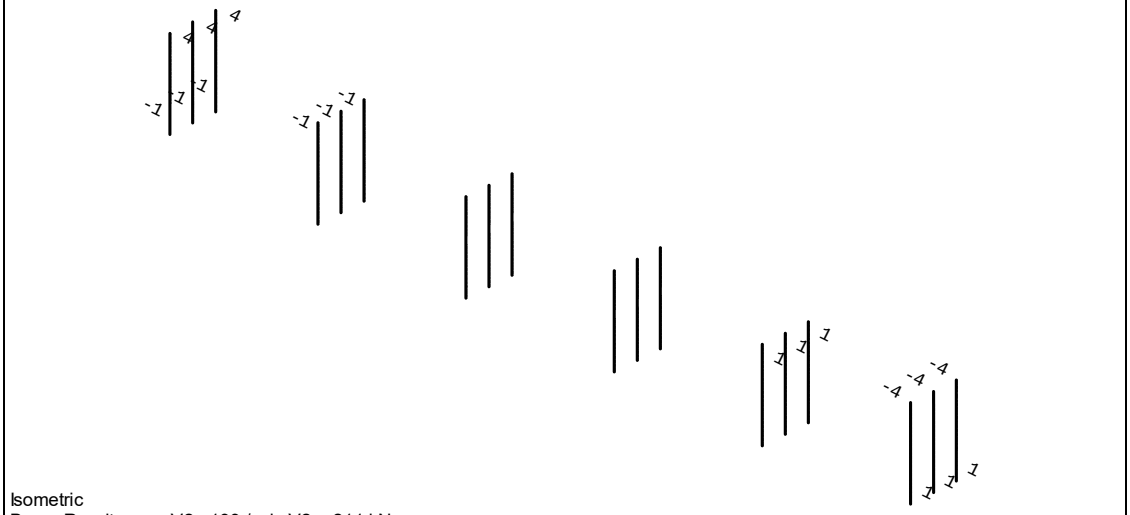

Load 11: dt-8
Isometric
Beam Results: max M1= 138 / min M1= -138 kNm

Load 11: dt-8



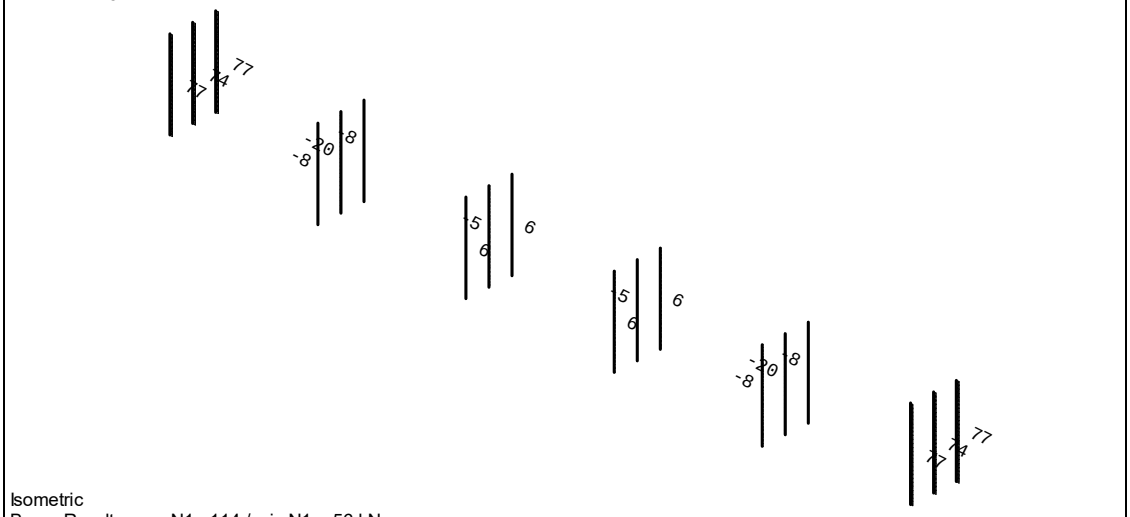
Isometric
Beam Results: max V3= 56 / min V3= -56 kN

Load 11: dt-8

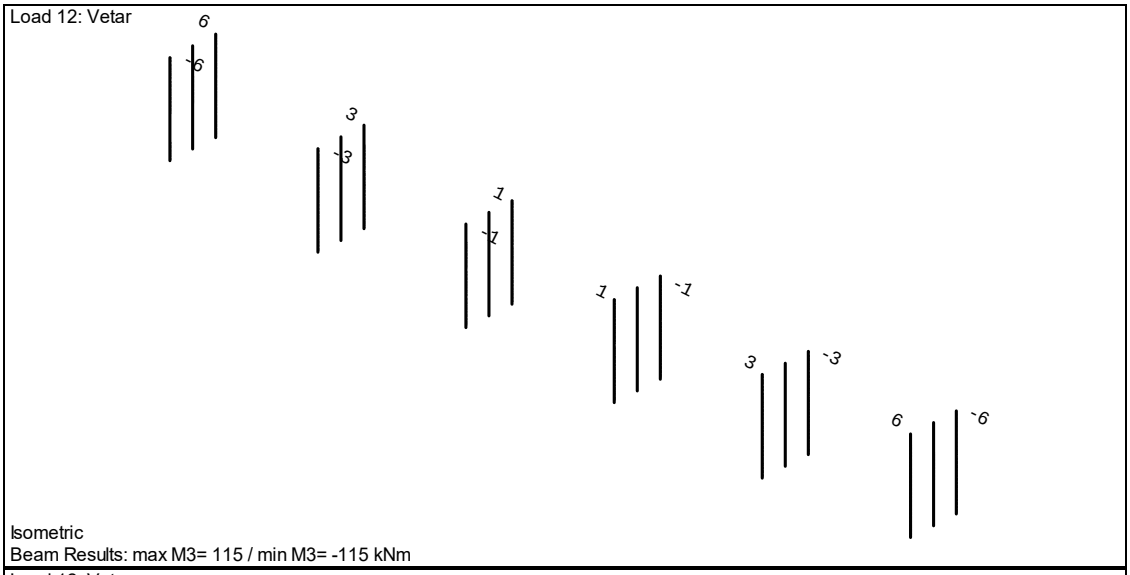


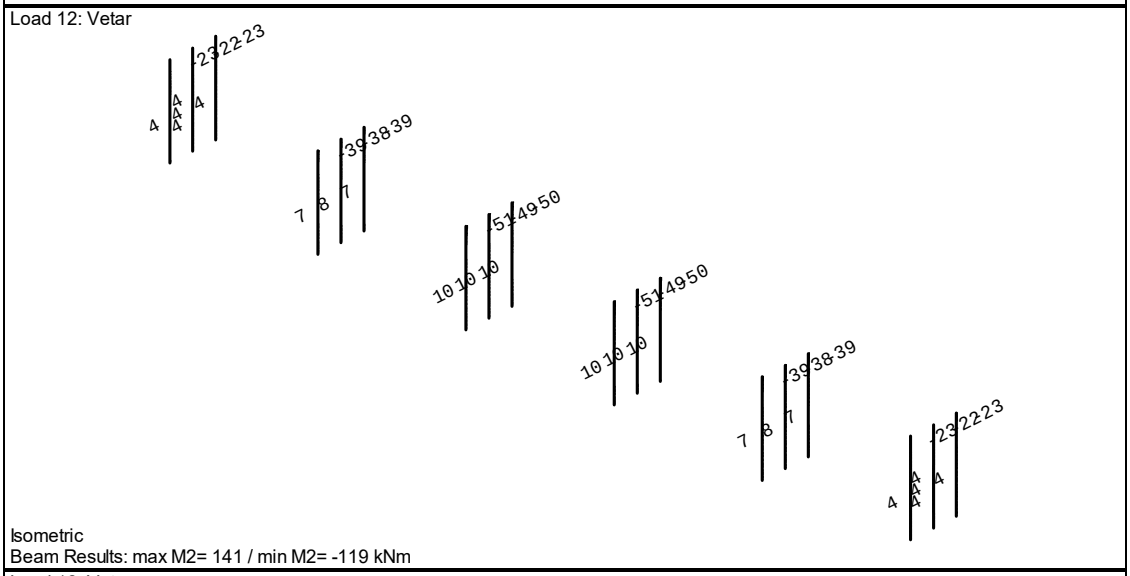
Isometric
Beam Results: max V2= 199 / min V2= -211 kN

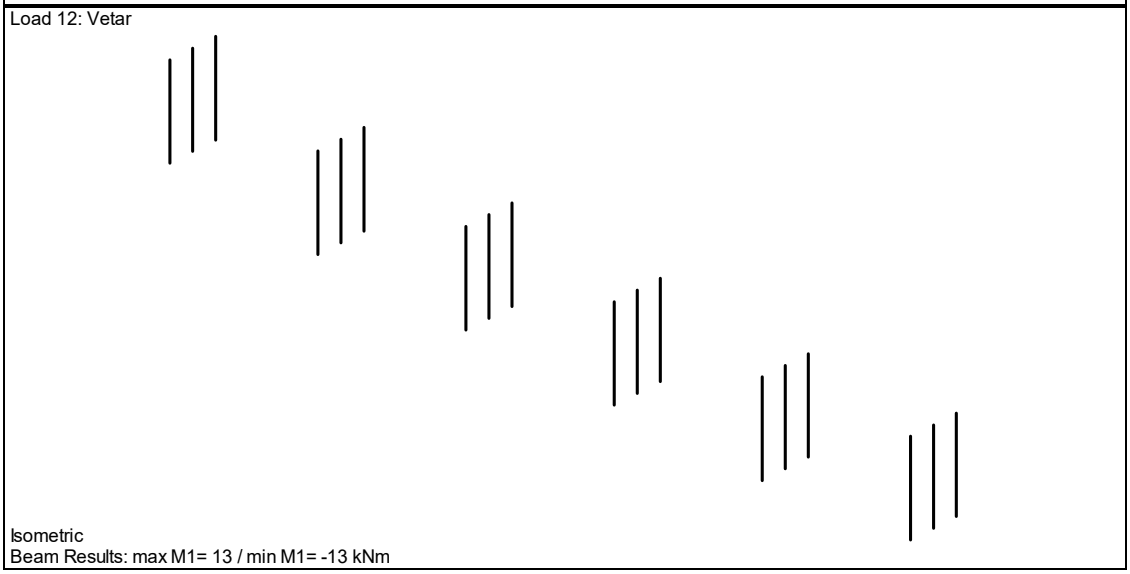
Load 11: dt-8



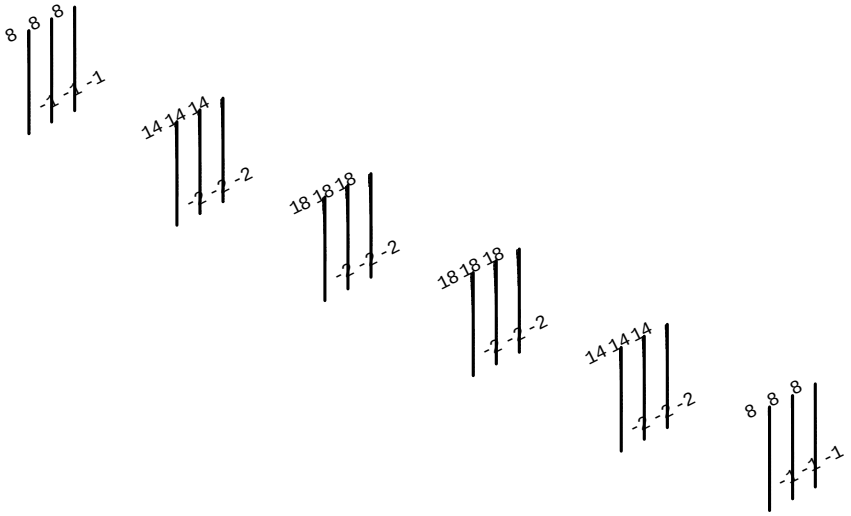
Isometric
Beam Results: max N1= 114 / min N1= -56 kN


Load 12: Vetar
Isometric
Beam Results: max M3= 115 / min M3= -115 kNm


Load 12: Vetar
Isometric
Beam Results: max M2= 141 / min M2= -119 kNm

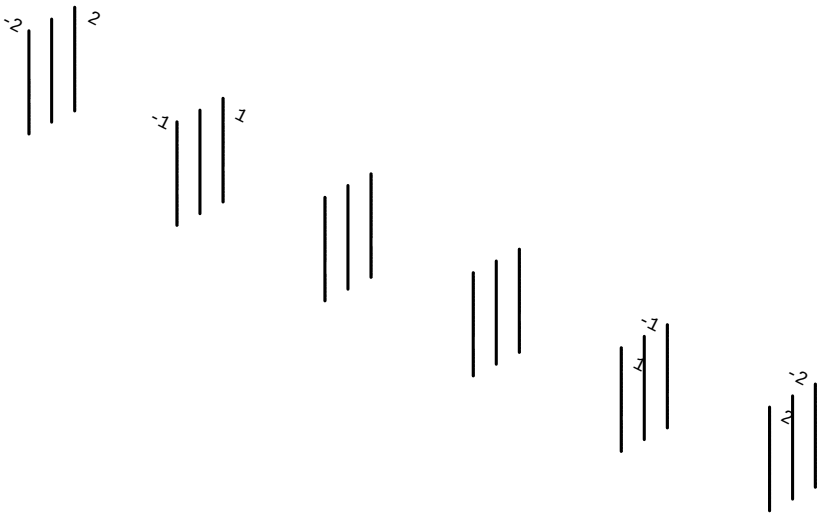

Load 12: Vetar
Isometric
Beam Results: max M1= 13 / min M1= -13 kNm

Load 12: Vetar



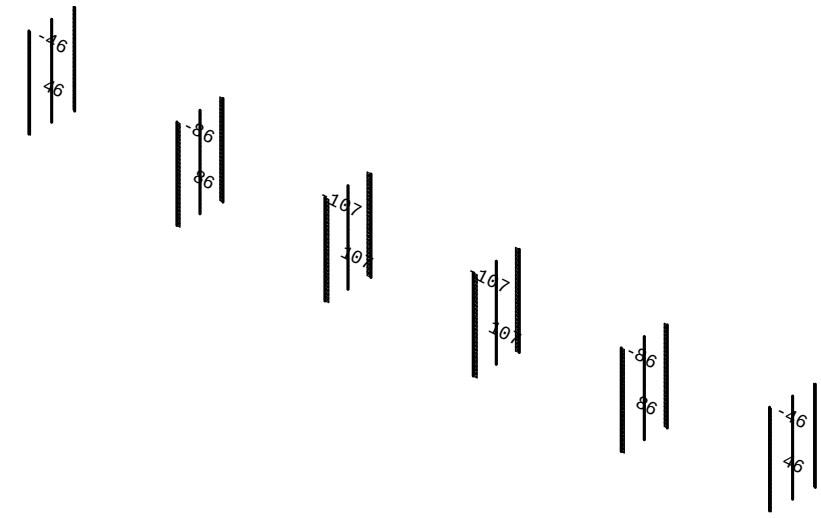
Isometric
Beam Results: max V3= 29 / min V3= -3 kN

Load 12: Vetar

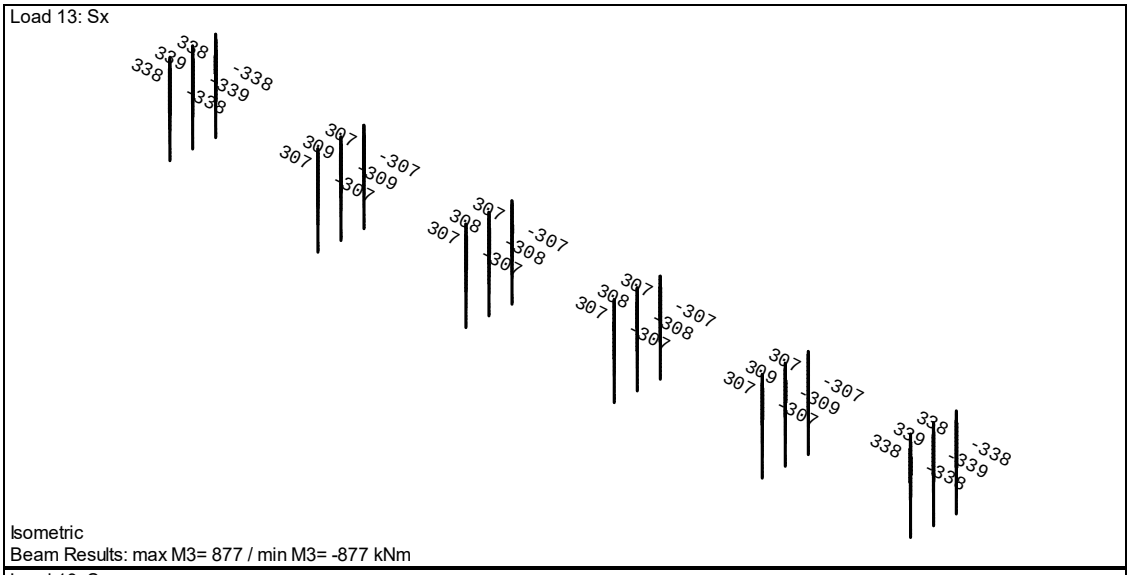


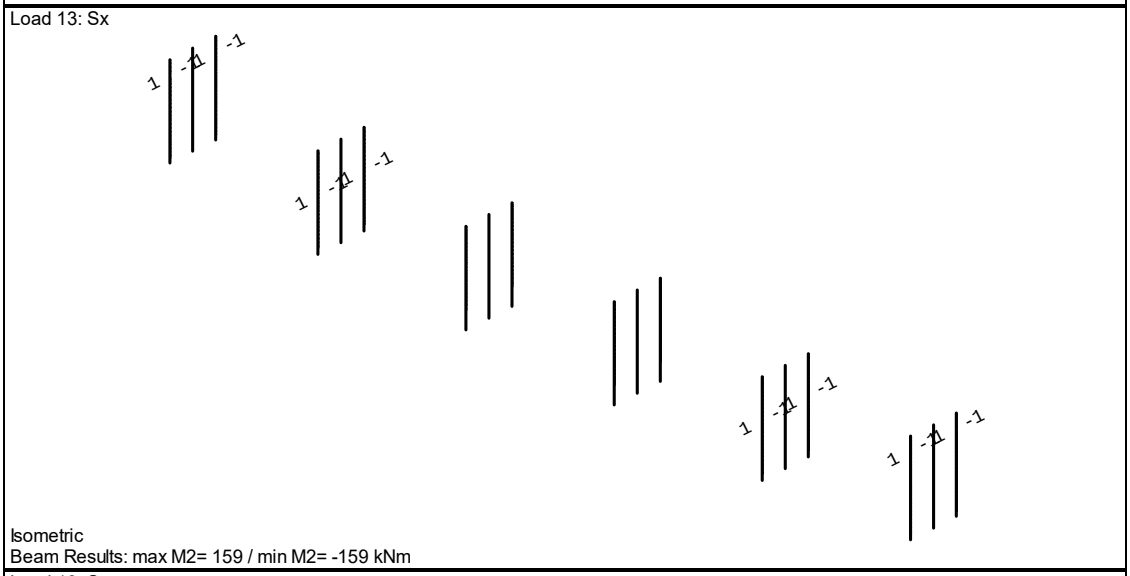
Isometric
Beam Results: max V2= 107 / min V2= -46 kN

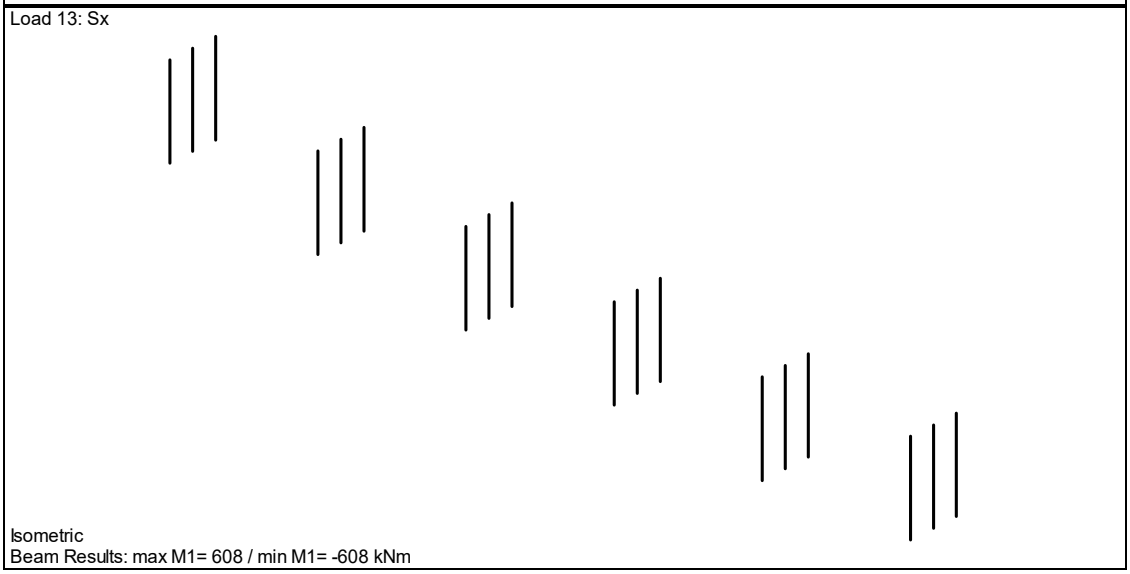
Load 12: Vetar



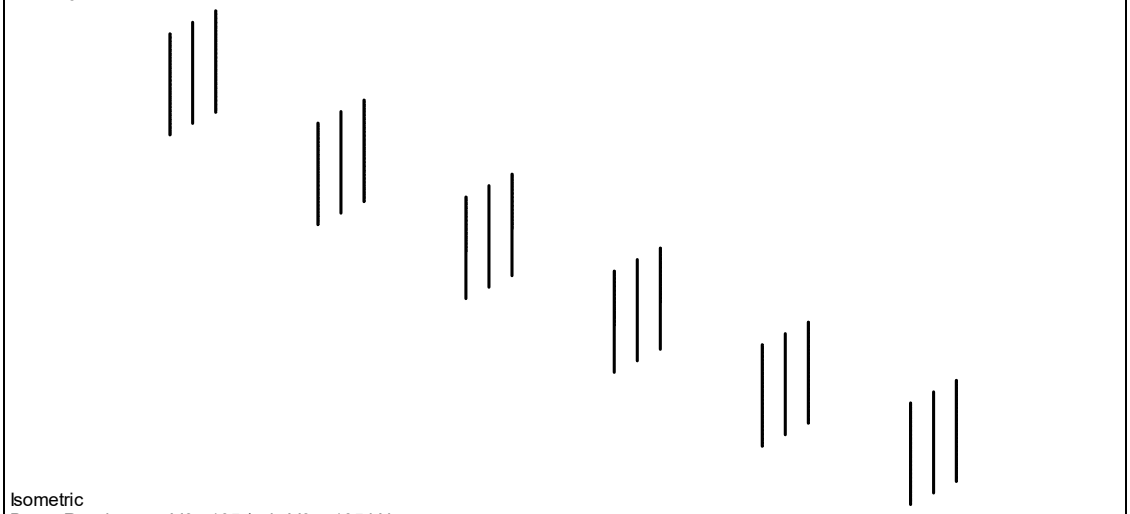
Isometric
Beam Results: max N1= 107 / min N1= -107 kN


Load 13: Sx
Isometric
Beam Results: max M3= 877 / min M3= -877 kNm


Load 13: Sx
Isometric
Beam Results: max M2= 159 / min M2= -159 kNm

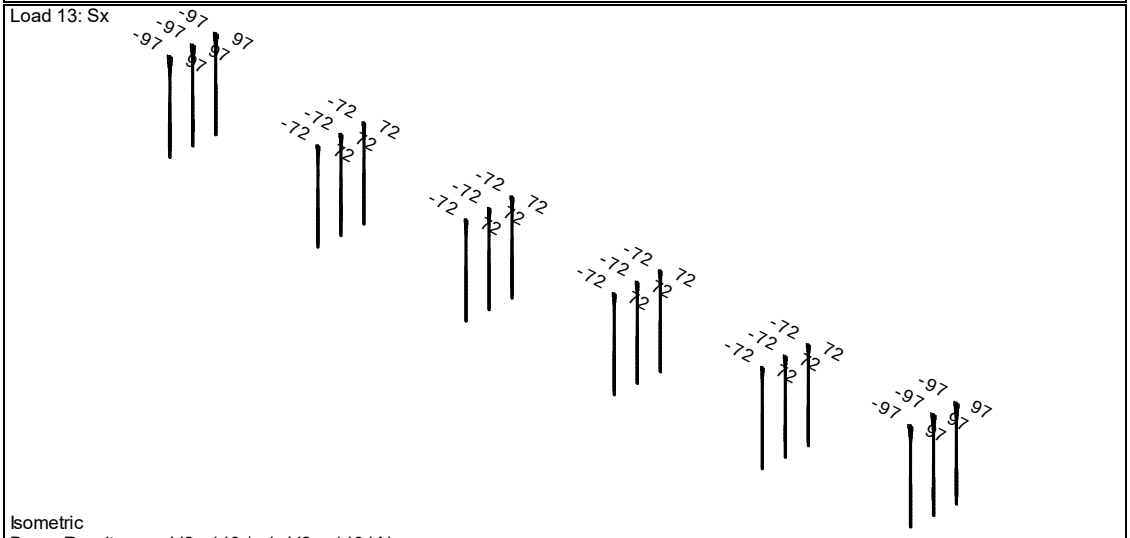

Load 13: Sx
Isometric
Beam Results: max M1= 608 / min M1= -608 kNm

Load 13: Sx



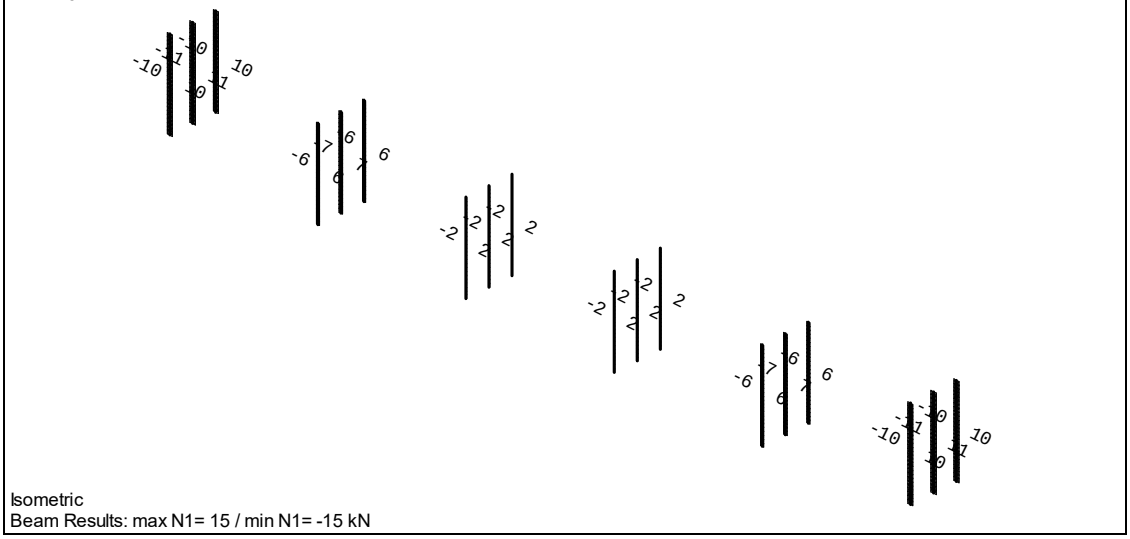
Isometric
Beam Results: max V3= 105 / min V3= -105 kN

Load 13: Sx

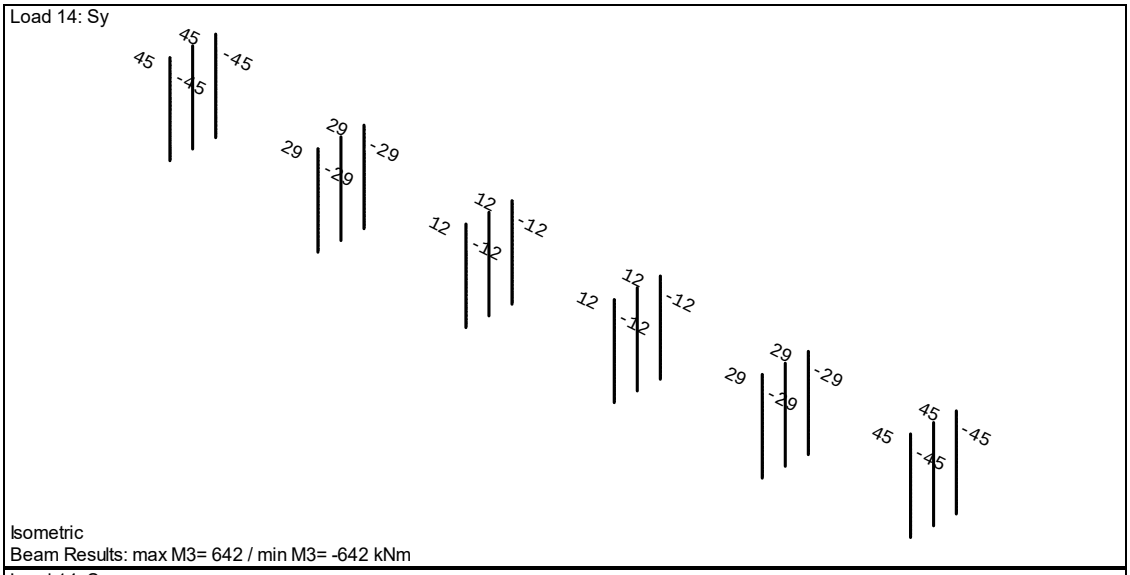


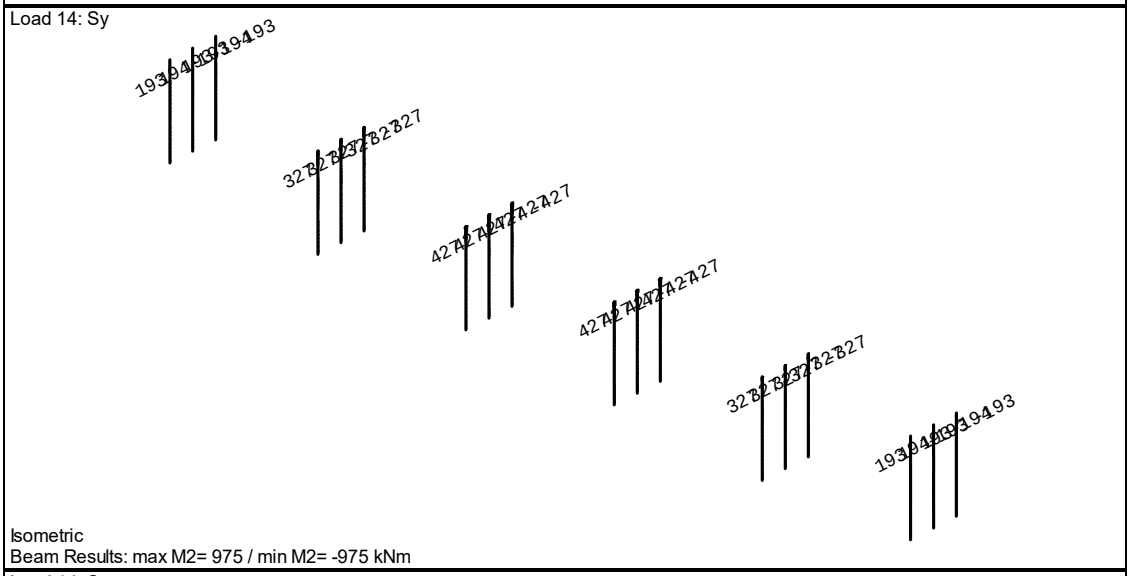
Isometric
Beam Results: max V2= 149 / min V2= -149 kN

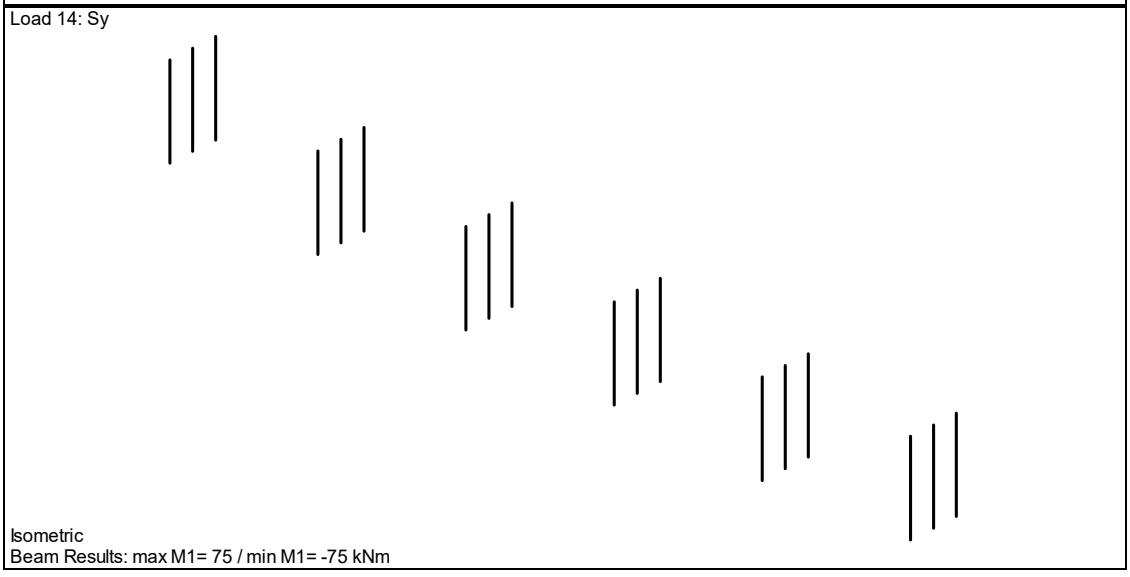
Load 13: Sx

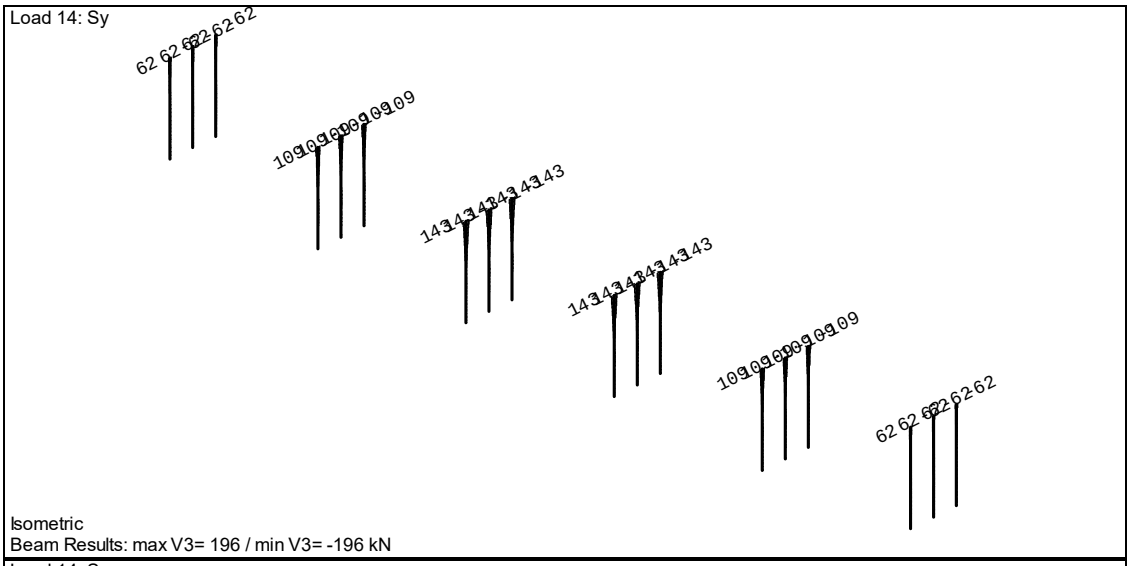


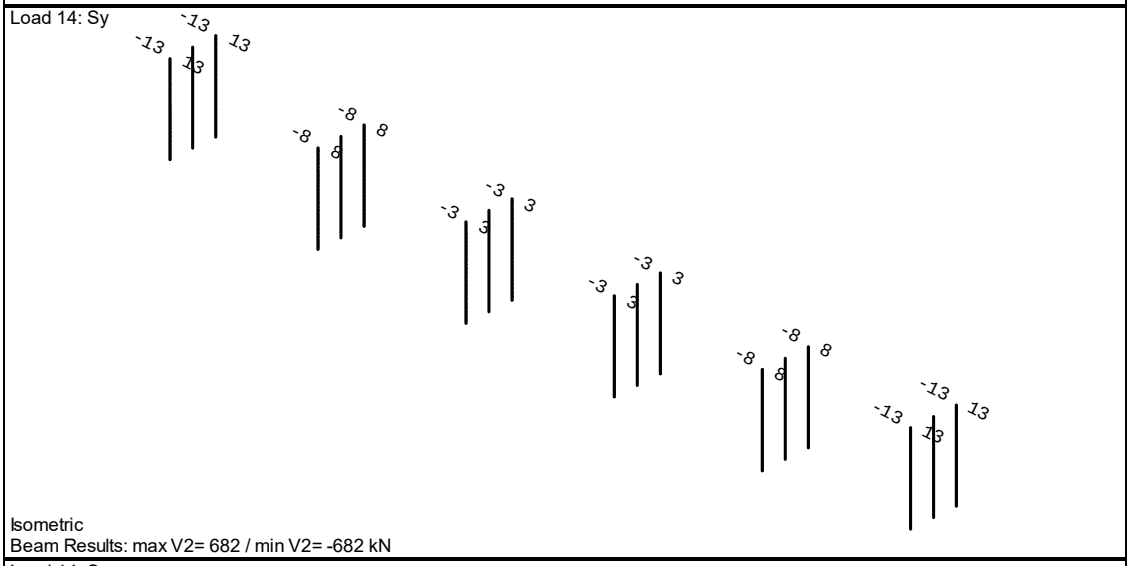
Isometric
Beam Results: max N1= 15 / min N1= -15 kN

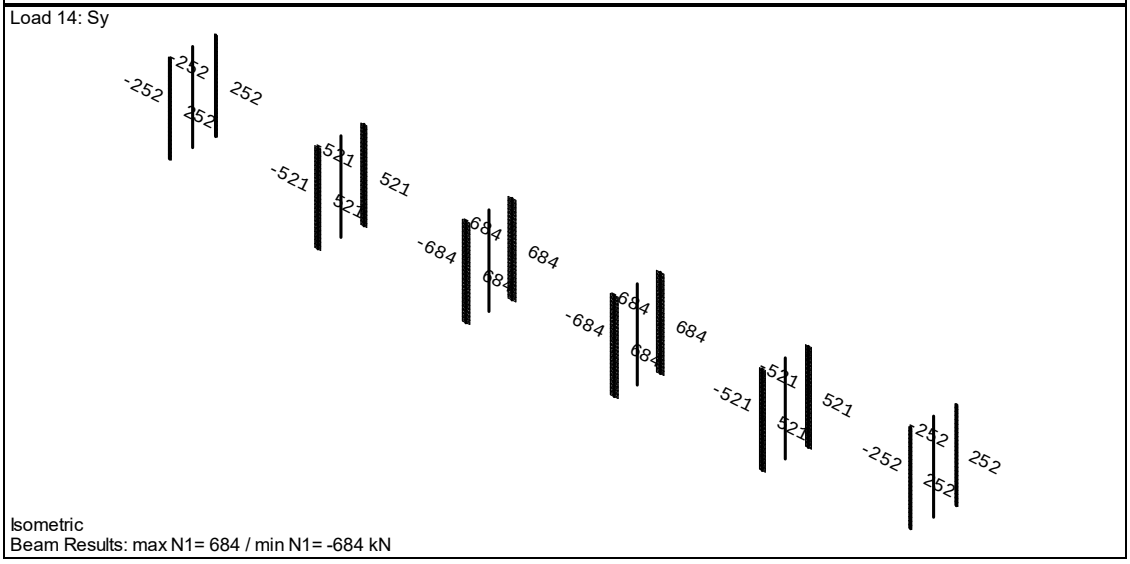

Load 14: Sy
Isometric
Beam Results: max M3= 642 / min M3= -642 kNm

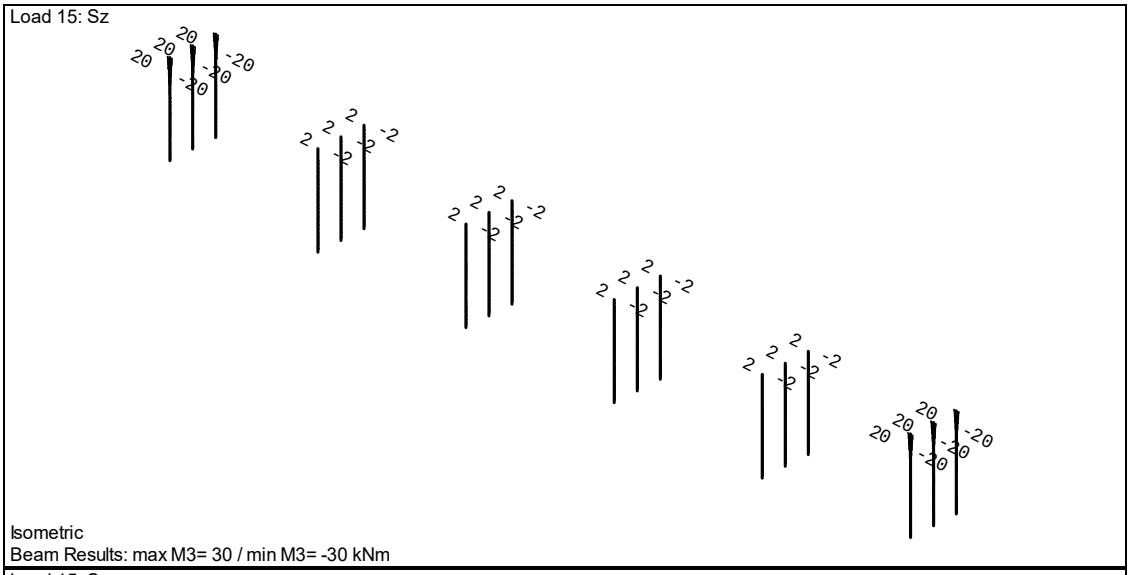

Load 14: Sy
Isometric
Beam Results: max M2= 975 / min M2= -975 kNm

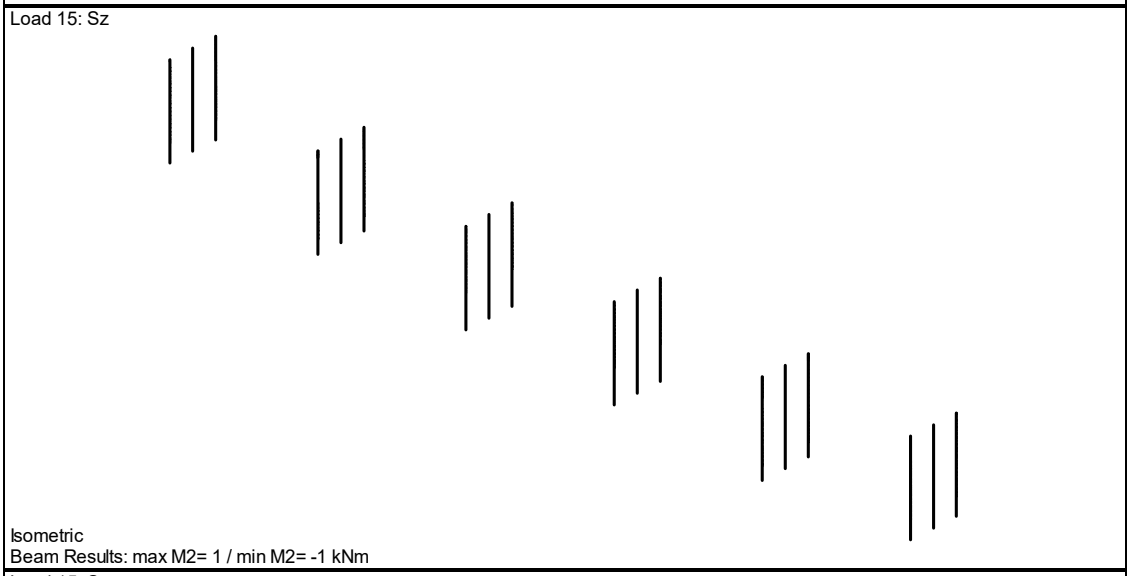

Load 14: Sy
Isometric
Beam Results: max M1= 75 / min M1= -75 kNm

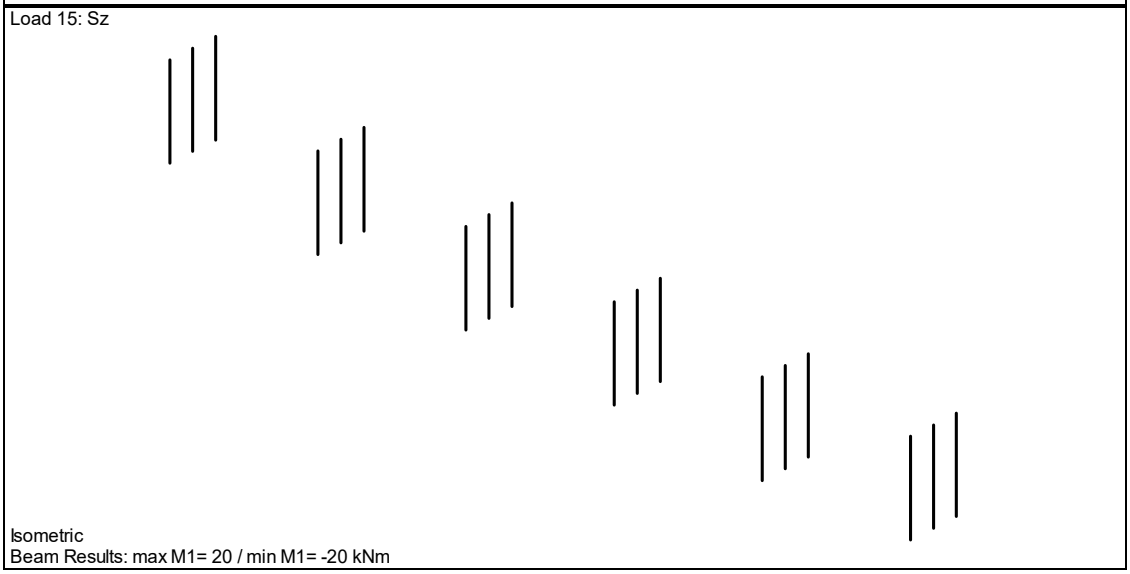

Load 14: Sy
Isometric
Beam Results: max V3= 196 / min V3= -196 kN


Load 14: Sy
Isometric
Beam Results: max V2= 682 / min V2= -682 kN

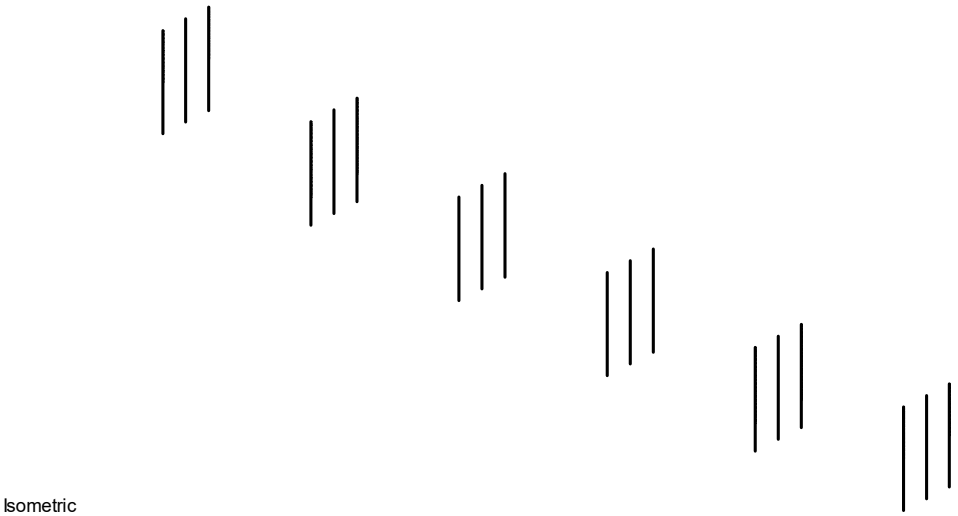

Load 14: Sy
Isometric
Beam Results: max N1= 684 / min N1= -684 kN


Load 15: Sz
Isometric
Beam Results: max M3= 30 / min M3= -30 kNm


Load 15: Sz
Isometric
Beam Results: max M2= 1 / min M2= -1 kNm

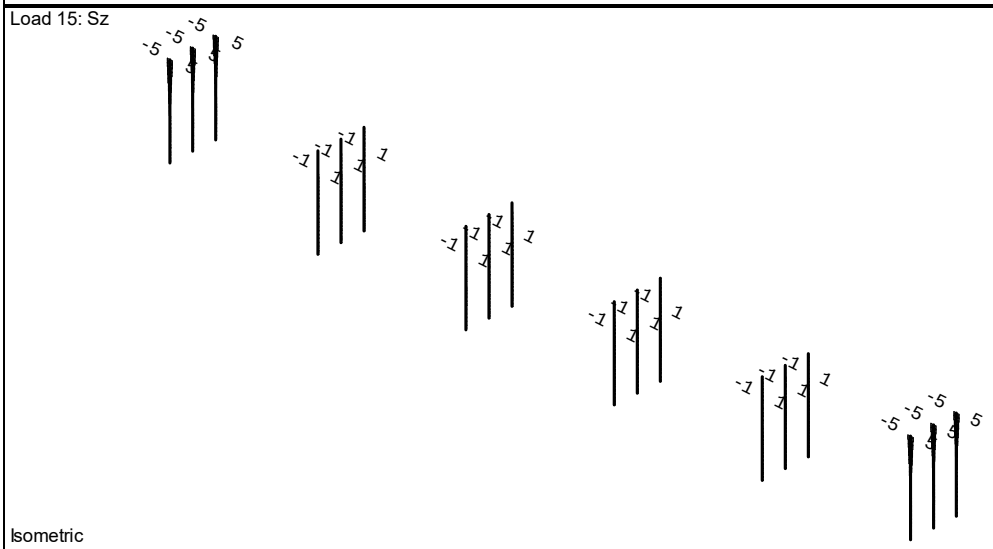

Load 15: Sz
Isometric
Beam Results: max M1= 20 / min M1= -20 kNm

Load 15: Sz



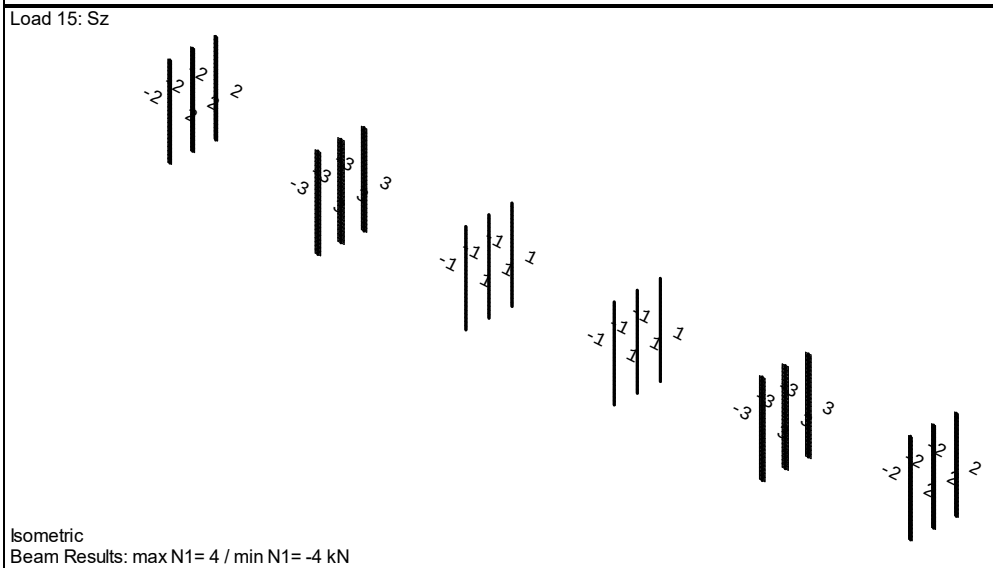
Isometric
Beam Results: max V3= 6 / min V3= -6 kN

Load 15: Sz



Isometric
Beam Results: max V2= 7 / min V2= -7 kN

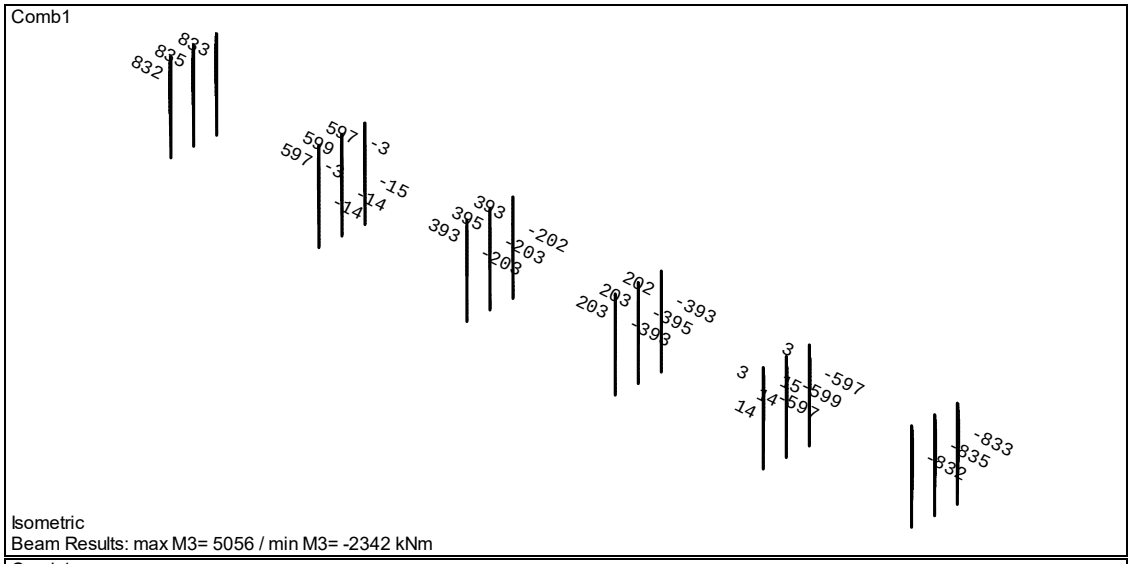
Load 15: Sz

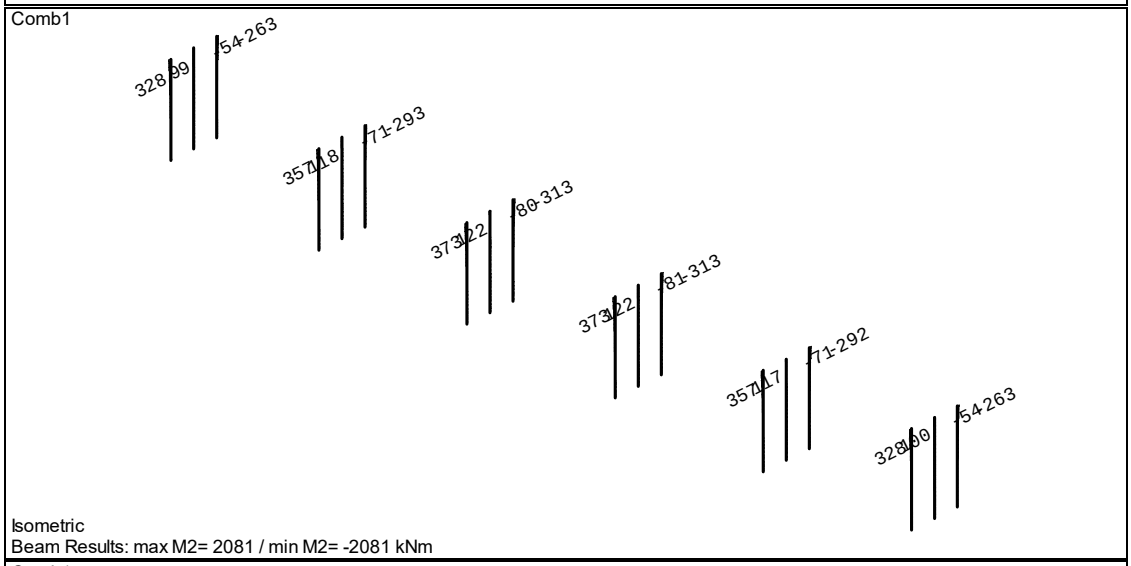


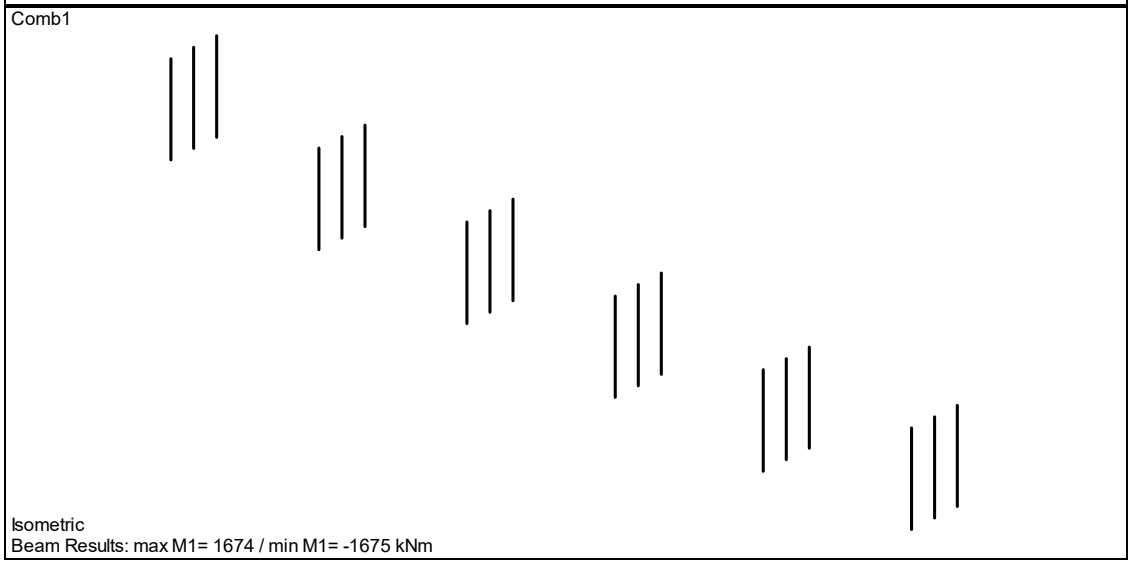
Isometric
Beam Results: max N1= 4 / min N1= -4 kN

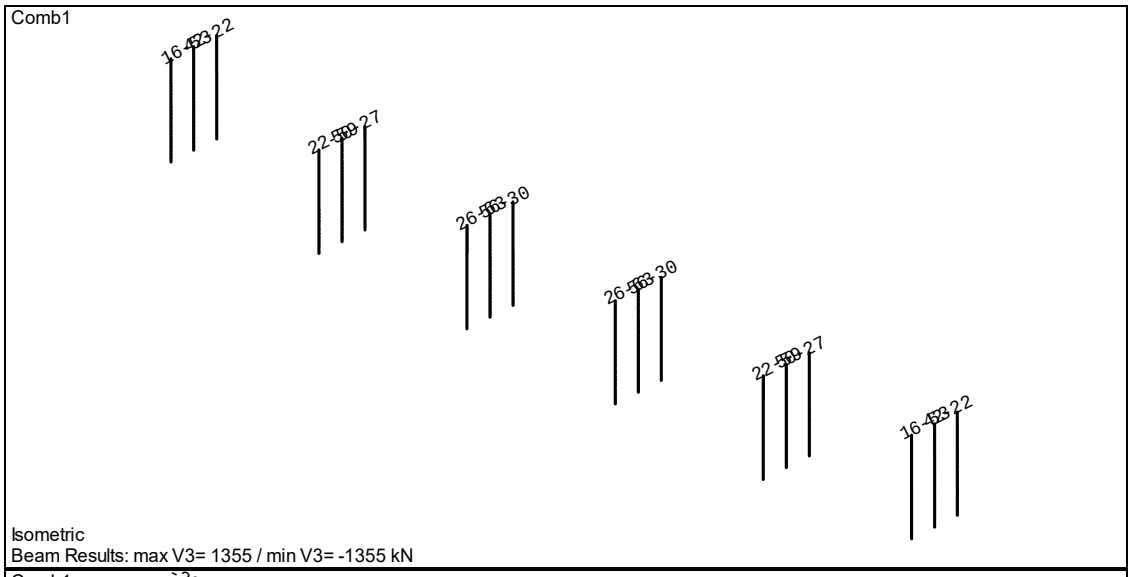
4.6.5.2 **Димензионисање /** Reinforcement design

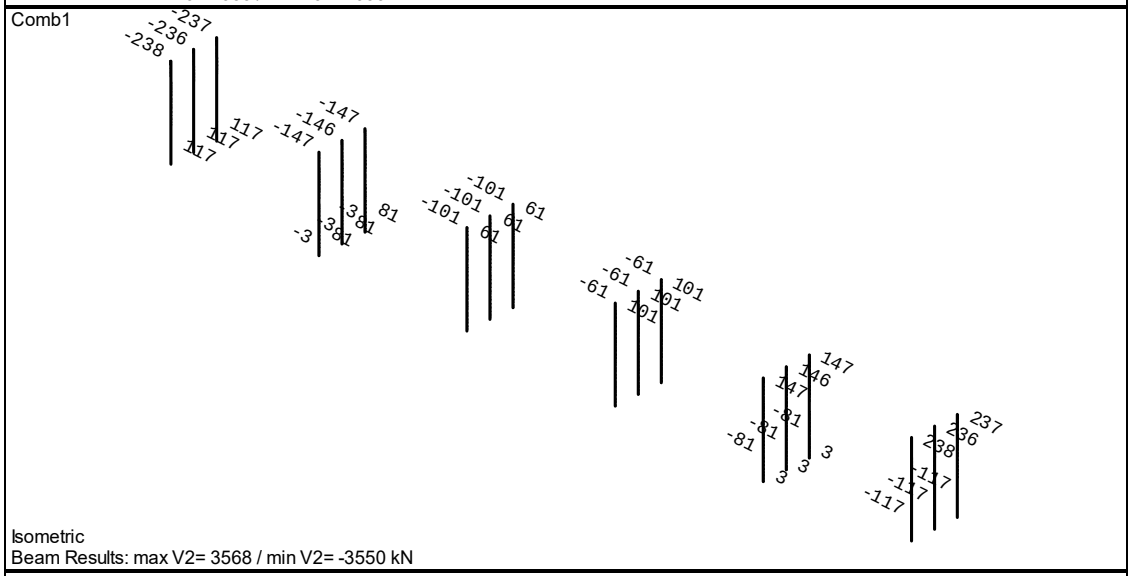
Comb 1

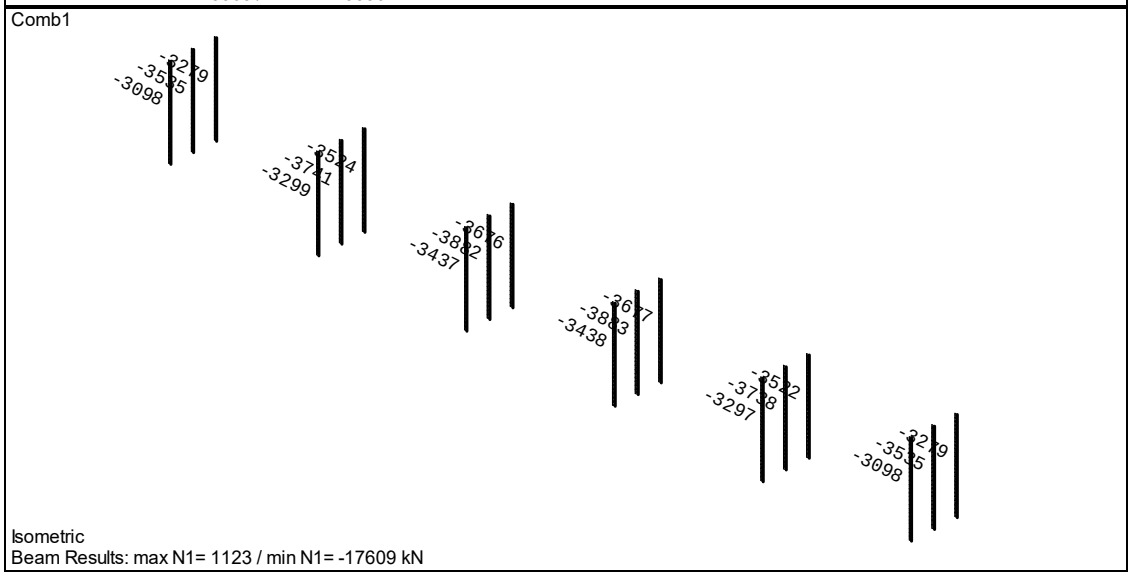


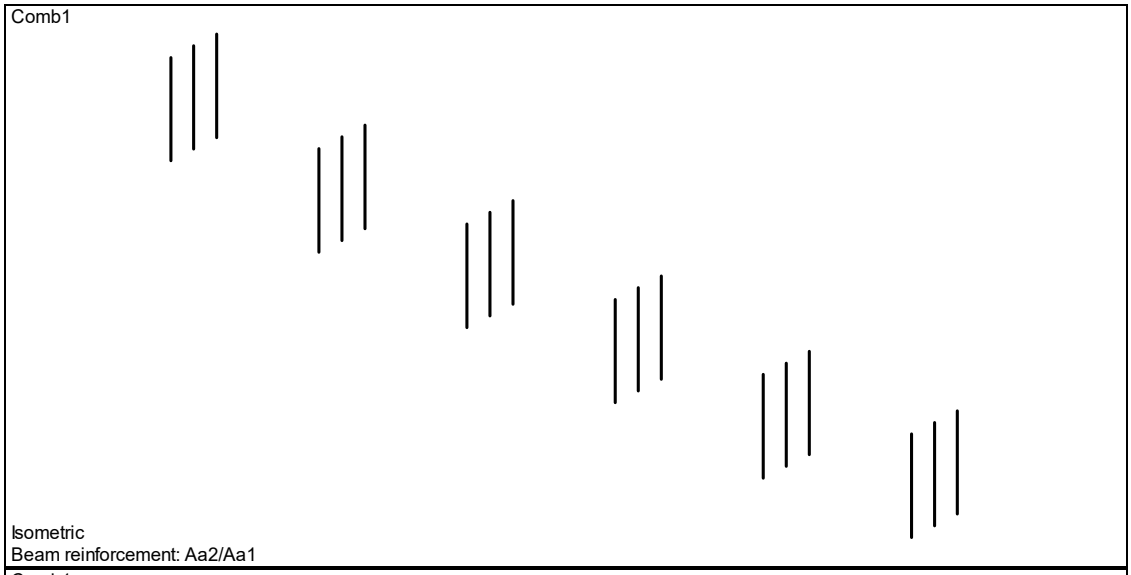


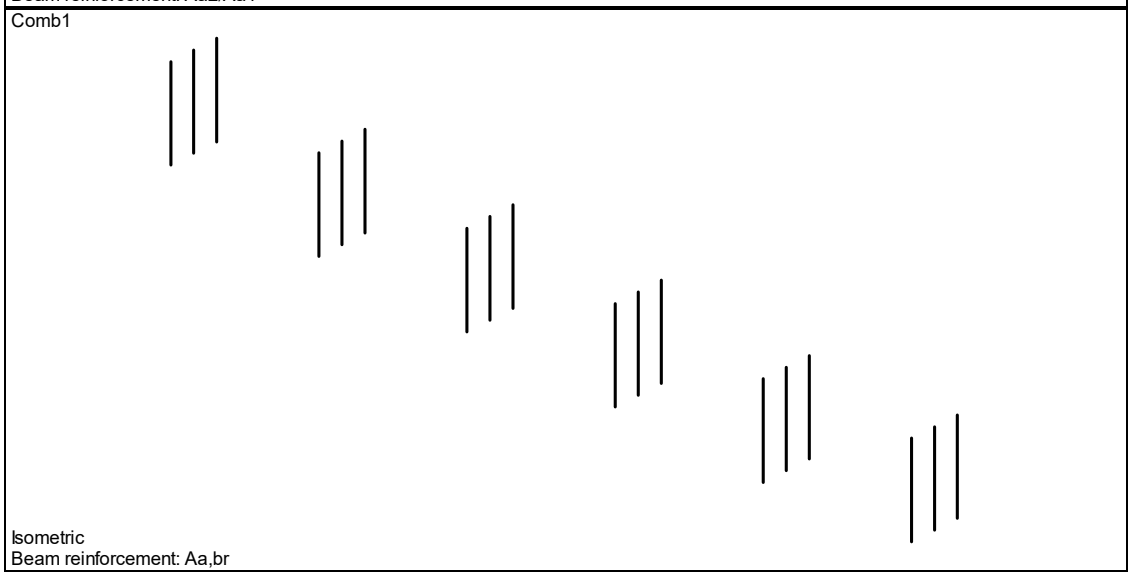



Comb1
Isometric
Beam Results: max V3= 1355 / min V3= -1355 kN

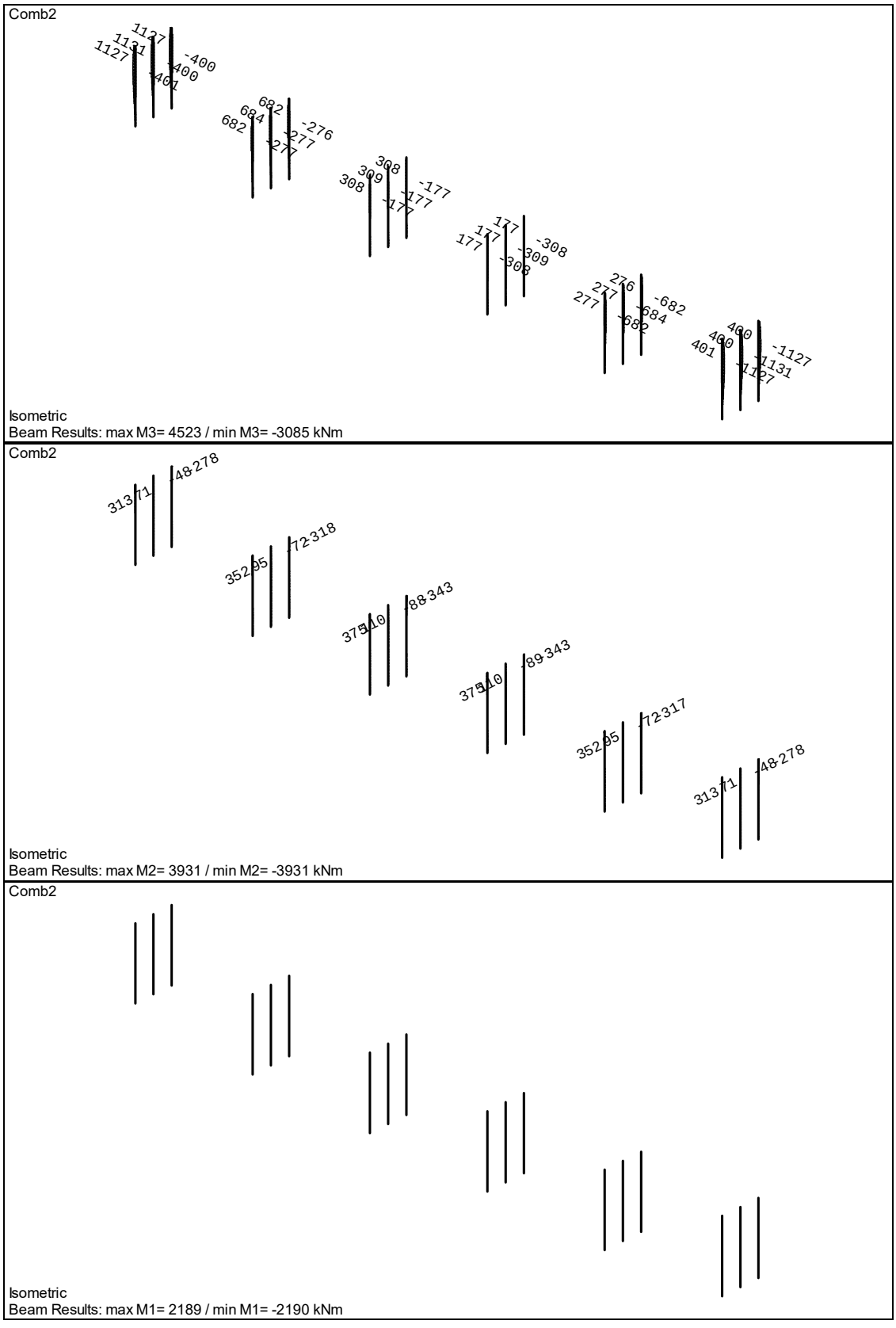

Comb1
Isometric
Beam Results: max V2= 3568 / min V2= -3550 kN

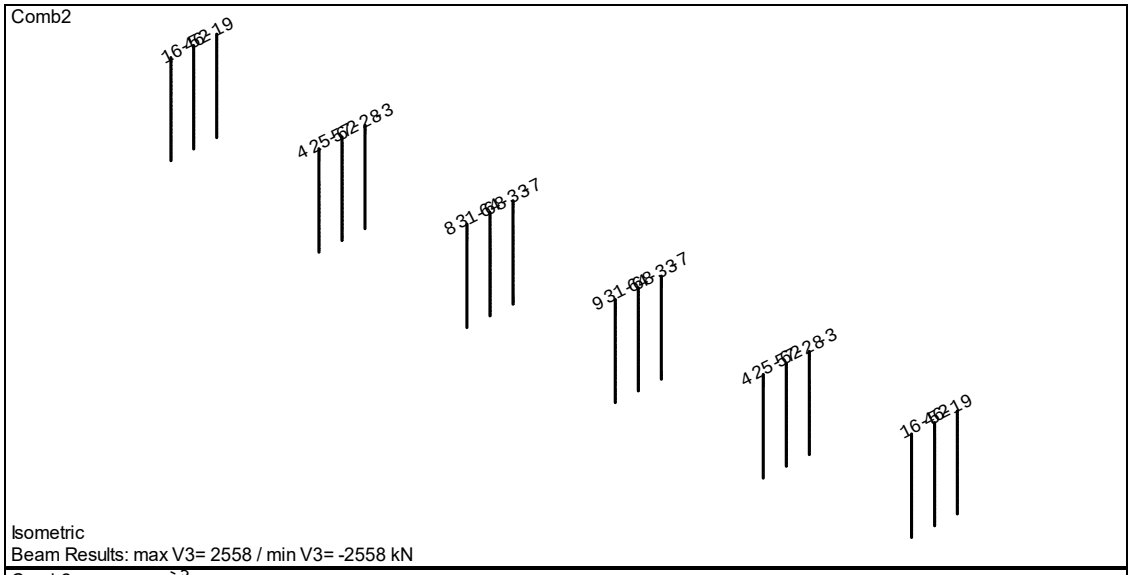

Comb1
Isometric
Beam Results: max N1= 1123 / min N1= -17609 kN

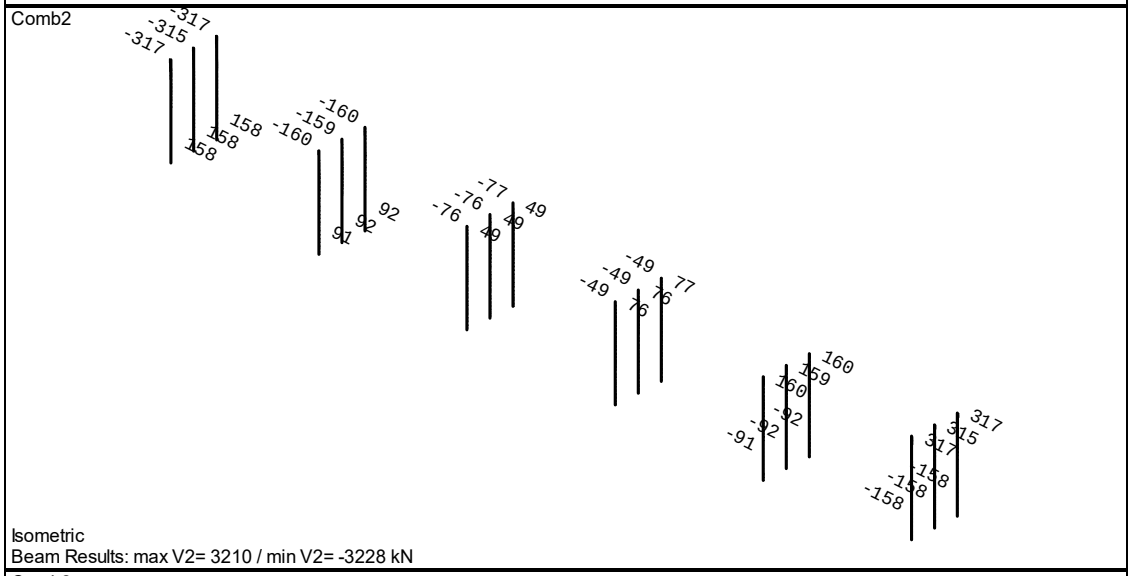

Comb1
Isometric
Beam reinforcement: Aa2/Aa1

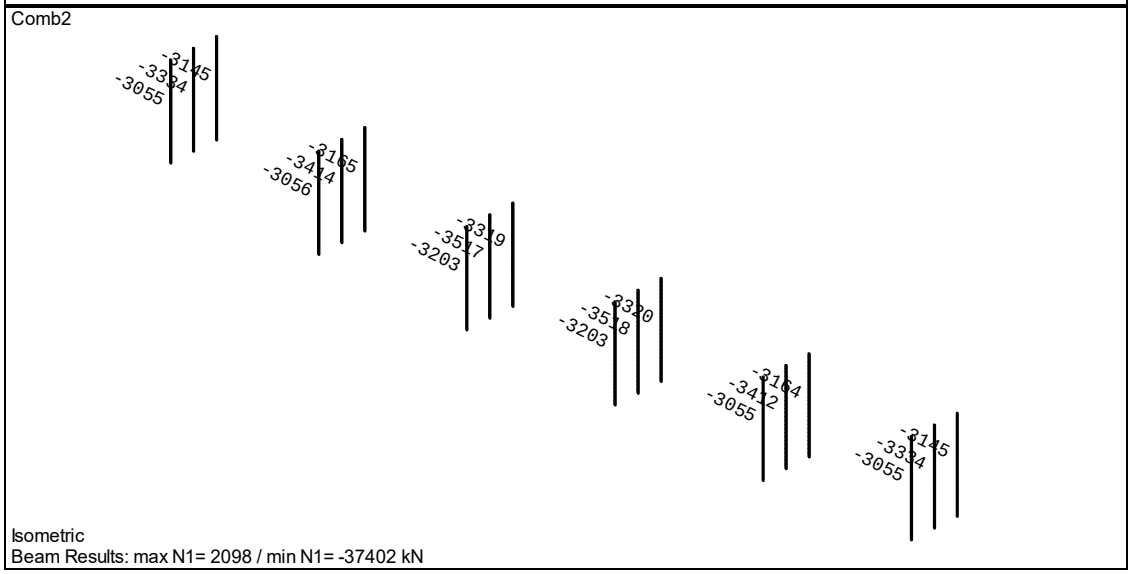

Comb1
Isometric
Beam reinforcement: Aa,br

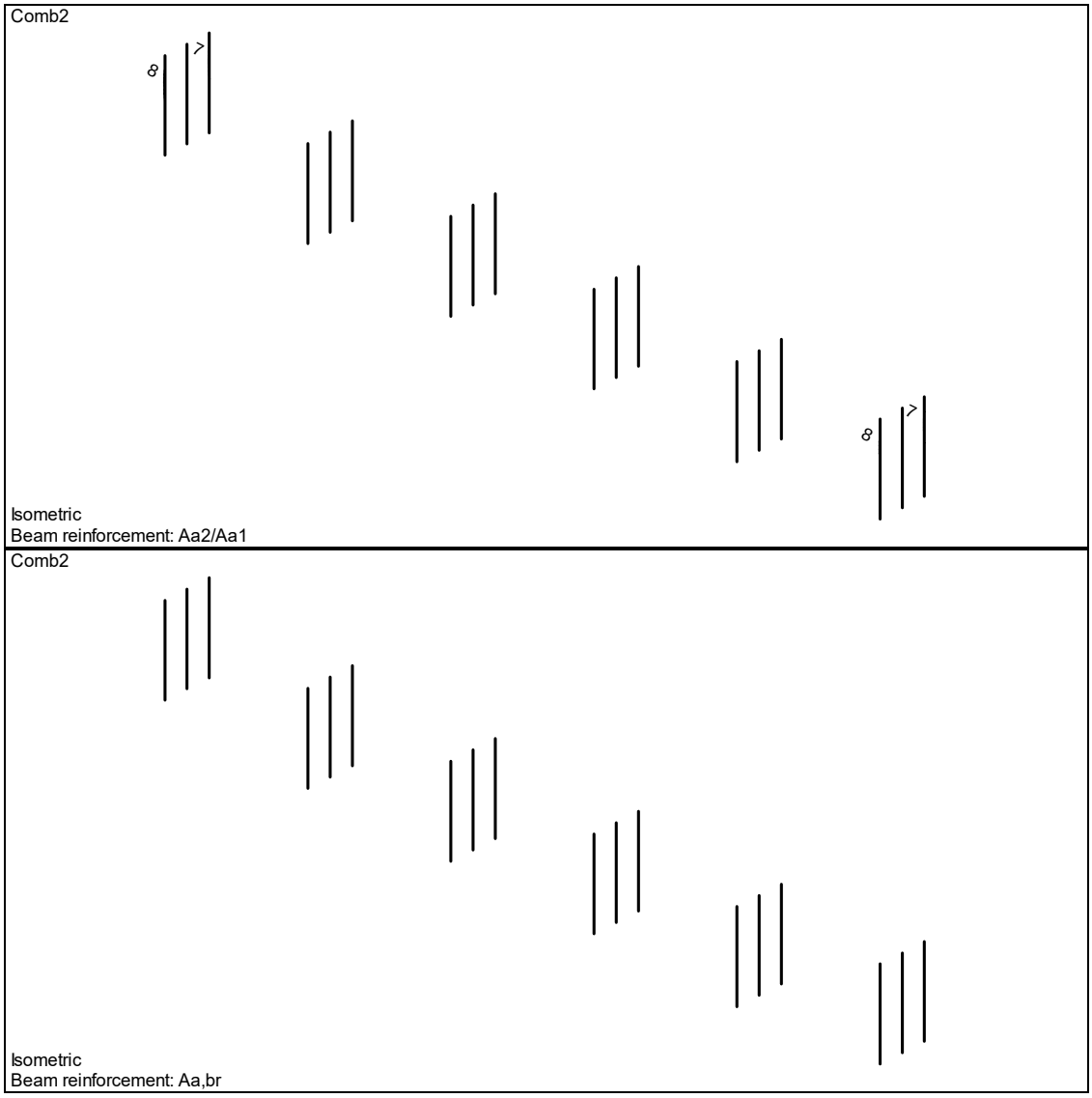
Comb 2


Comb2
Isometric
Beam Results: max M3= 4523 / min M3= -3085 kNm
Comb2
Isometric
Beam Results: max M2= 3931 / min M2= -3931 kNm
Comb2
Isometric
Beam Results: max M1= 2189 / min M1= -2190 kNm

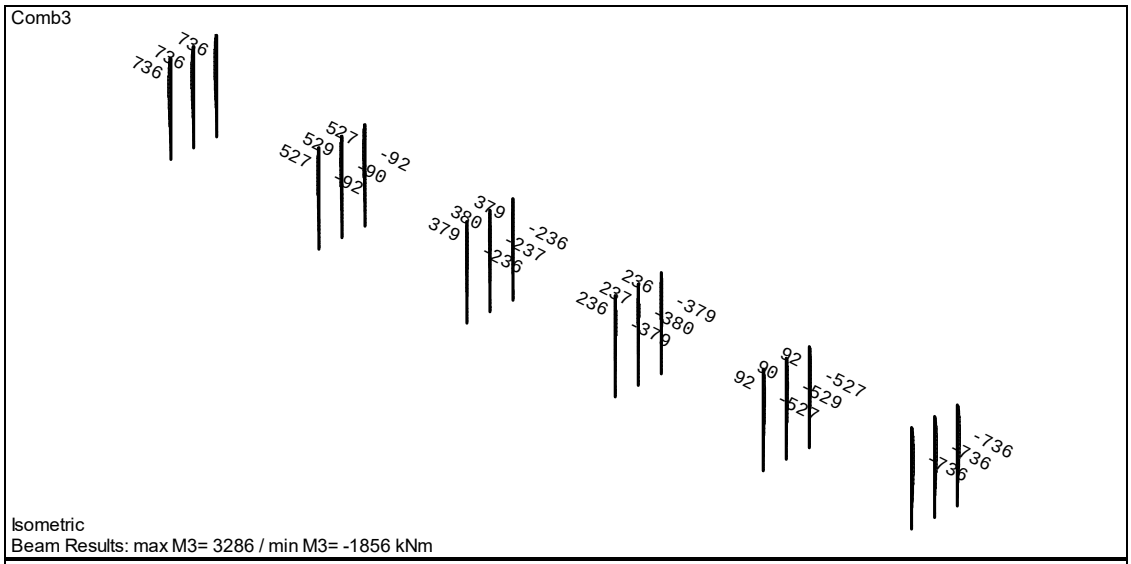

Comb2
Isometric
Beam Results: max V3= 2558 / min V3= -2558 kN

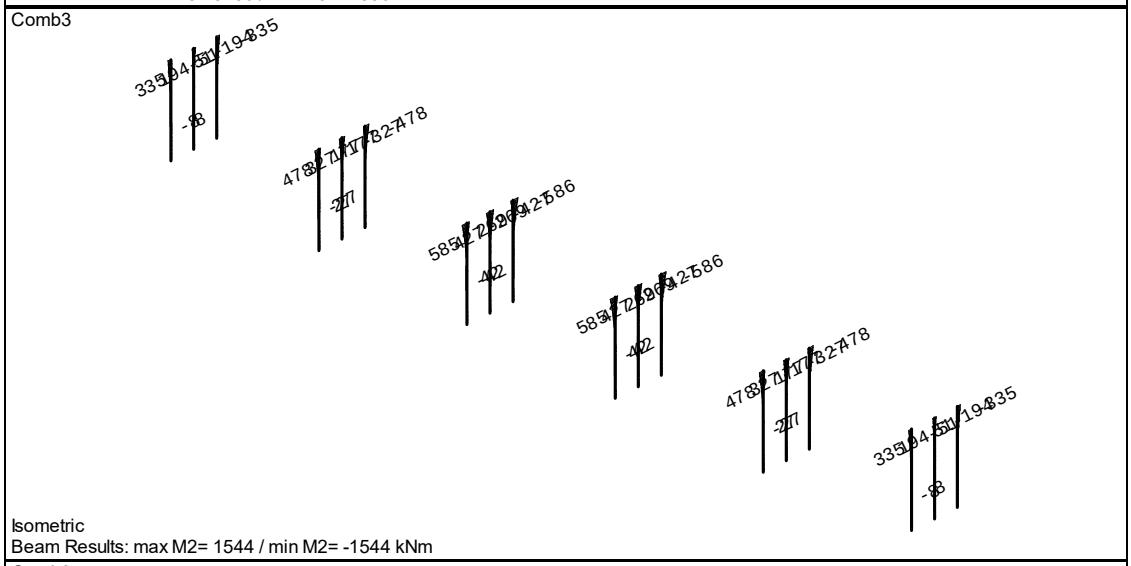

Comb2
Isometric
Beam Results: max V2= 3210 / min V2= -3228 kN

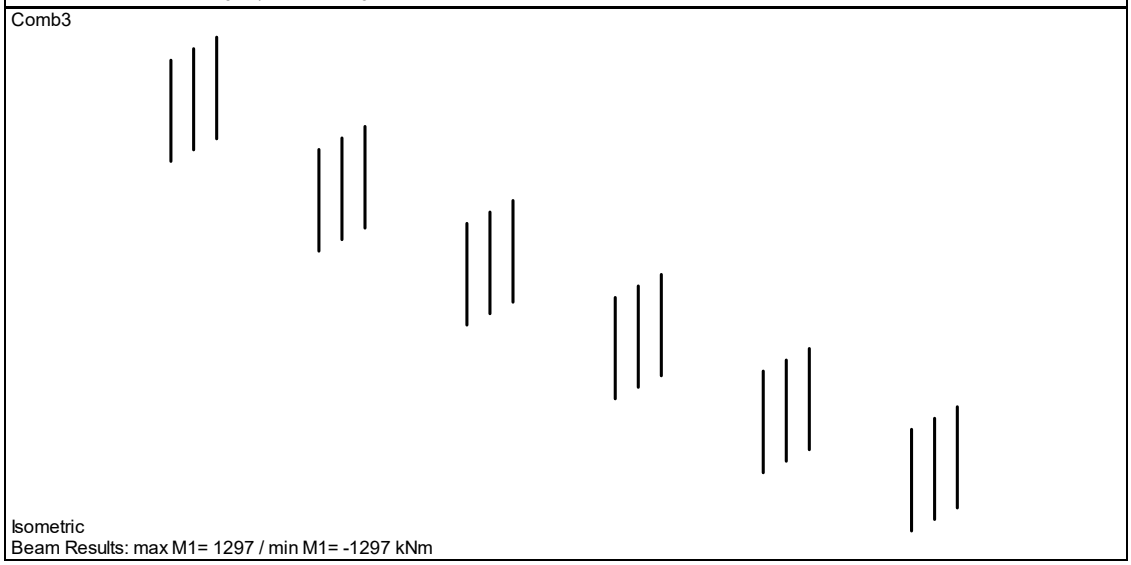

Comb2
Isometric
Beam Results: max N1= 2098 / min N1= -37402 kN

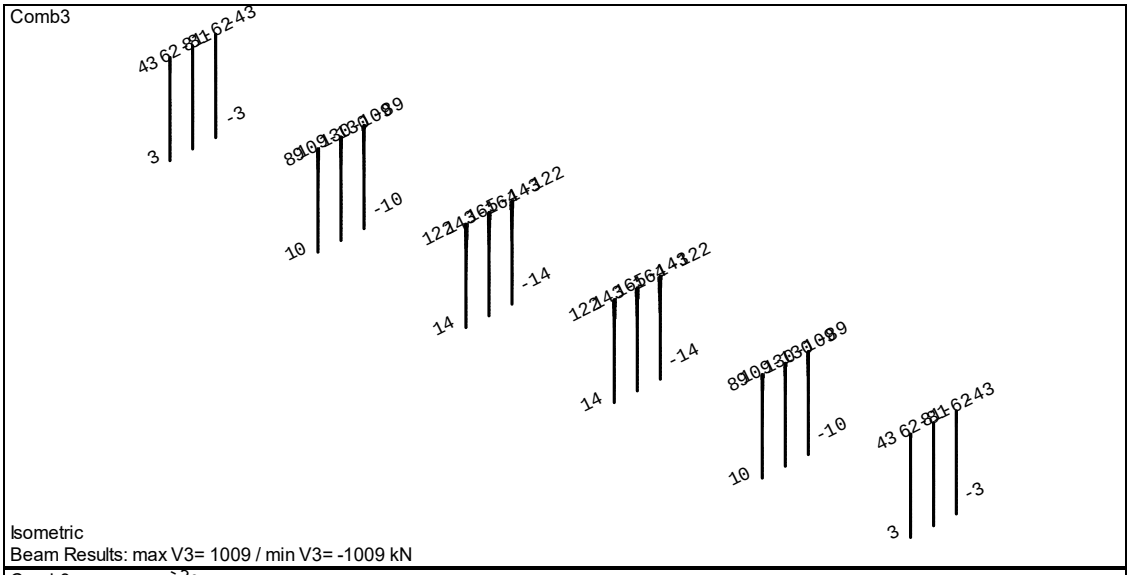

Comb2
Isometric
Beam reinforcement: Aa2/Aa1
Comb2
Isometric
Beam reinforcement: Aa,br

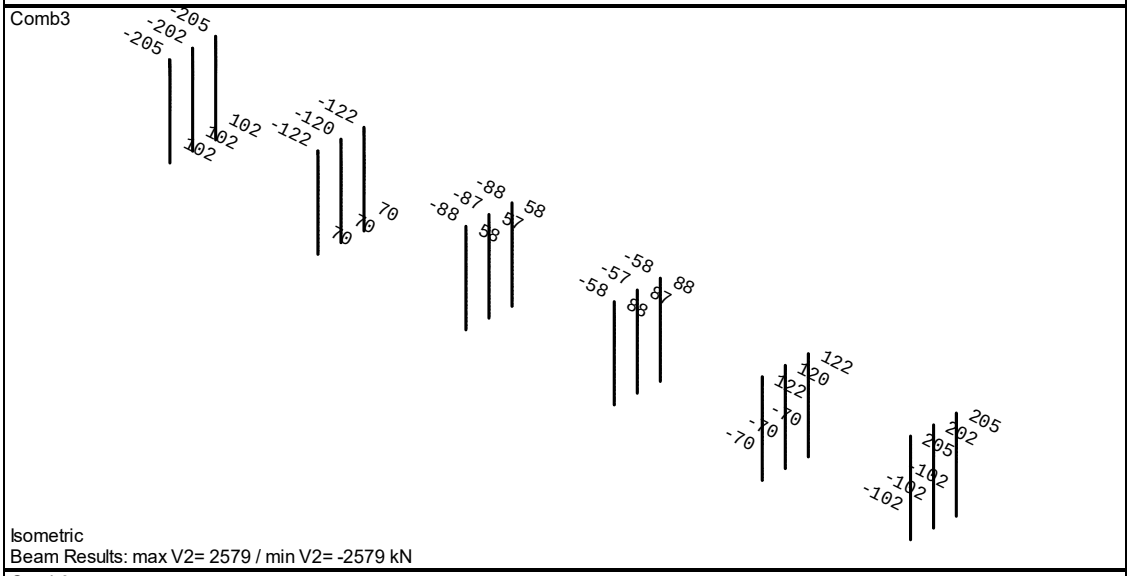
Comb 3

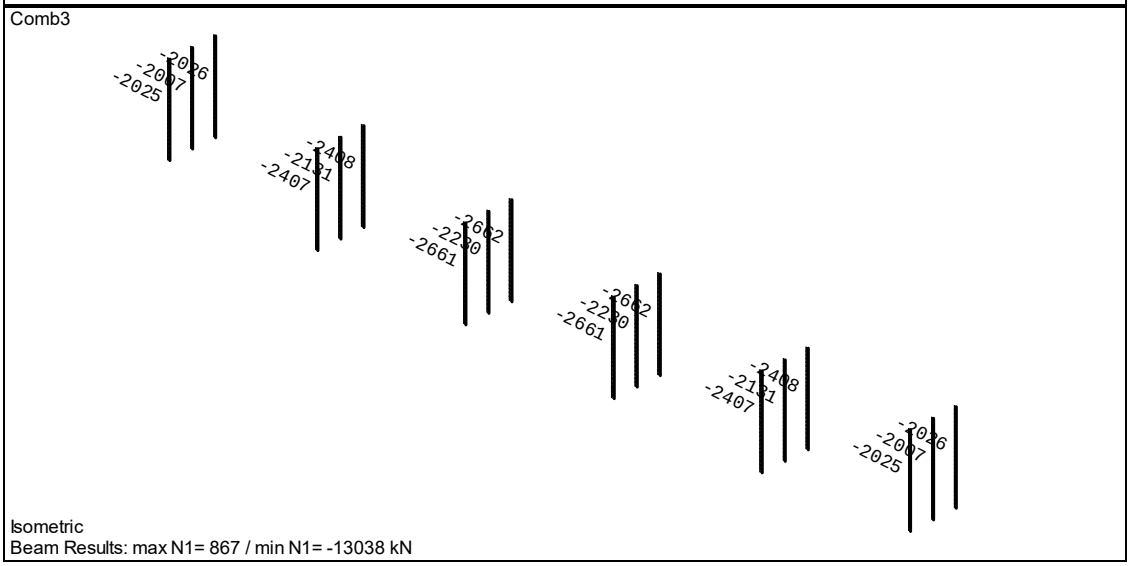

Comb3
Isometric
Beam Results: max M3= 3286 / min M3= -1856 kNm

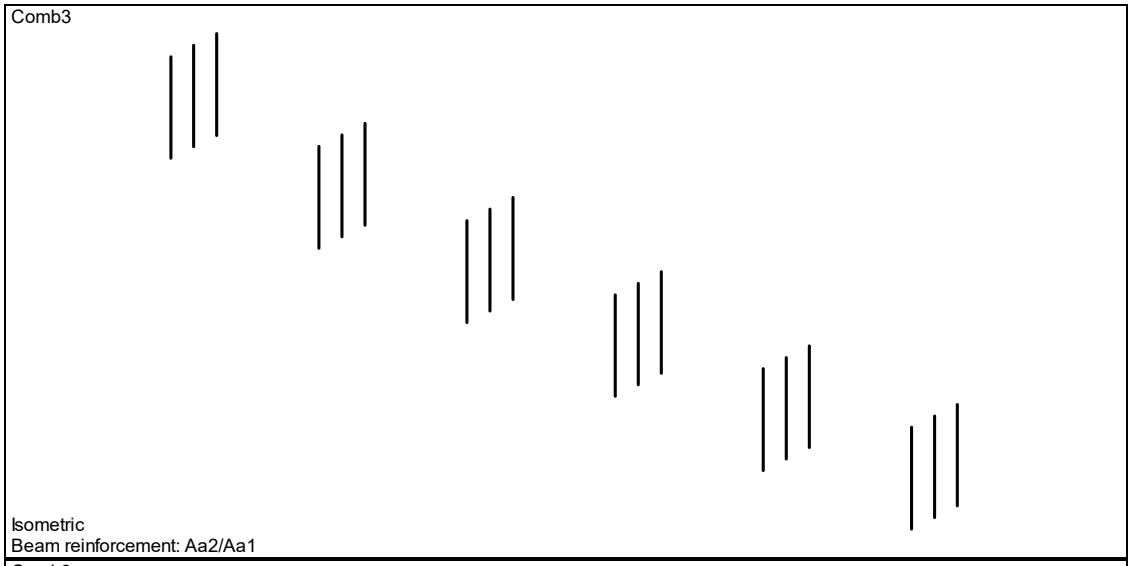

Comb3
Isometric
Beam Results: max M2= 1544 / min M2= -1544 kNm

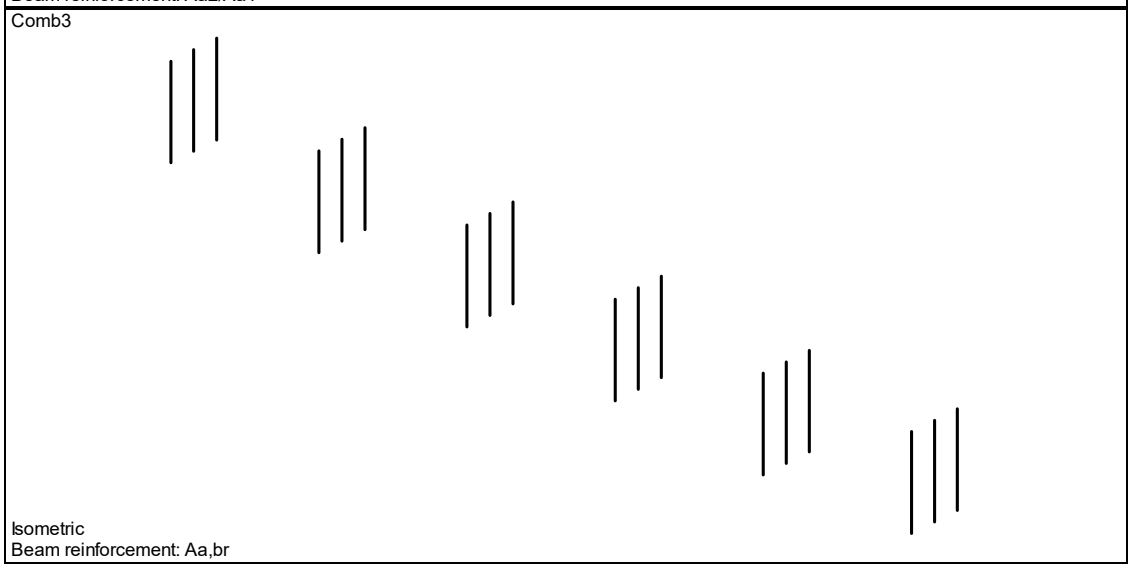

Comb3
Isometric
Beam Results: max M1= 1297 / min M1= -1297 kNm


Comb3
Isometric
Beam Results: max V3= 1009 / min V3= -1009 kN


Comb3
Isometric
Beam Results: max V2= 2579 / min V2= -2579 kN


Comb3
Isometric
Beam Results: max N1= 867 / min N1= -13038 kN


Comb3
Isometric
Beam reinforcement: Aa2/Aa1


Comb3
Isometric
Beam reinforcement: Aa,br

Потребна арматура / required reinforcement

Вертикална арматура / Vertical reinforcement

Aa = 8 cm2

Смичућа арматура / Shear reinforcement

Aa = 0 cm2/m

Minimalna armatura / Minimum reinforcement

Φ120 cm → Ac = 11304 cm2

Aa,min = 0.0025xAc = 0.0025x11304 = 28.26 cm2

Usvojena armatura / provided reinforcement :

Podužna armatura / Longitudinal reinforcement

18Φ20/20 (Aa = 56.52 cm2) **Вертикална арматура** / Vertical reinforcement Φ12/15 (Aa = 7.54 cm2/m) → **узенгије** / stirrups

Maksimalna sila u šipu / Maximal axial force

	ULS	SLS
	Nmax	Nmax
S1	3550	3177
S2	3535	2619
S3	3741	2771
S4	3883	2876
S5	3883	2876
S6	3741	2771
S7	3535	2619
S8	3550	3177

Извод из геомеханичког елаборате / Geotechnical report

1 SEISMICITY OF THE TERRAIN

According to (SRPS EN 1998-2), the input parameters for seismic analysis are derived from the condition that the object, with an average service life of 50 years, does not collapse, which corresponds to seismic action with a probability of exceeding 10% over a period of 50 years. This earthquake has a return period of events of T_{NCR} = 475 years.

The second condition is that limited damage can occur only as a consequence of an earthquake, for probability which can be exceeded by up to 10% in a period of 10 years or an earthquake that has an average return period of 95 years.

To estimate the seismicity of the terrain, the map of the Republic Seismological Institute was used - the map of seismic hazard of the Republic of Serbia, which is expressed in degrees of macroseismic intensity (MCS) and the map of seismic hazard of the Republic of Serbia expressed in units of horizontal acceleration (g).

The subject location, on oleates of macroseismic intensity of earthquakes, is located in zone VI ° MCS for a return period of 95 years, and in zone VII ° MCS for a return period of 475 years. The value of the horizontal acceleration of soil oscillation (a_{gr}) is 0.03g for the return period of 95 years, and 0.05g for the return period of 475 years.

According to the soil typification (SRPS EN 1998-1), the soil is characterized as a soil of "C" type - deposits of dense or medium-dense sand, gravel or solid clay, with shear wave velocity in range from 180-360 m/s and Nspt blows in range from 15-50.
It is recomended that the soil is characterized as "E" type - alluvial soil with 5-20 m thickness that is characterized ether as C or D with stiffer or firmer soil underneath.

According to the typification of the category of the object (SRPS EN 1998-2), the planned overpass belongs to the category: bridge of class II importance.

According to Eurocode 8, the design soil acceleration a_g is represented by the product of the factor of significance of the object γ_I and the reference maximum soil acceleration a_{gr}. As the significance factor for the bridge of class II importance γ_I is 1.0, the value of the design acceleration a_g is 0.29 m/s^2 for the first condition and 0.49 m/s^2 for the second condition.

Type I elastic response spectrum is recommended.

Table 1. - Values of period parameters wich describing the recommended type I elastic response spectrum

Type of soil	S	T_B	T_C	T_D
C	1.15	0.20 s	0.60 s	2.0 s
E	1.40	0.15 s	0.50 s	2.0 s

Table 11. – Overview of adopted soil parameters for pillar site I

Layer designation	z (m)	d (m)	γ (kN/m³)	φ (°)	c (kN/m²)	Mv (MN/m²)	ν	E_s (MN/m²)	E_p (MN/m²)	k_h (MN/m³) *Vesić*	k_h (MN/m³) *Mayerhof & Baike*
CII	2.3	2.3	20	18	23	2.4	0.4	1.12	30000	0.40	1.11
	3.3	1.0	20					2.05		0.77	2.04
	5.4	2.1	10								
siSa	8.3	2.9	10	30	5	13.5	0.3	10.03		3.94	9.18
	10.6	2.3	10					4.90		1.81	4.49
	13.7	3.1	10					14.99		5.77	13.01
SaP	22.3	8.6	10	33	7	32.3	0.2	29.03		11.81	25.20

Table 12. – Overview of adopted soil parameters for pillar site II

Layer designation	z (m)	d (m)	γ (kN/m³)	φ (°)	c (kN/m²)	Mv (MN/m²)	ν	E_s (MN/m²)	E_p (MN/m²)	k_h (MN/m³) *Vesić*	k_h (MN/m³) *Mayerhof & Baike*
CII	2.3	2.3	20	18	23	2.4	0.4	1.12	30000	0.40	1.11
	3.5	1.2	20					2.05		0.77	2.04
	5.1	1.6	10								
siSa	8.3	3.2	10	30	5	13.5	0.3	10.03		3.94	9.18
	10.6	2.3	10					4.90		1.81	4.49
	13.9	3.3	10					14.99		5.77	13.01
SaP	22.3	8.4	10	33	7	32.3	0.2	29.03		11.81	25.20

Table 13. – Overview of adopted soil parameters for pillar site III

Layer designation	z (m)	d (m)	γ (kN/m³)	φ (°)	c (kN/m²)	Mv (MN/m²)	ν	E_s (MN/m²)	E_p (MN/m²)	k_h (MN/m³) *Vesić*	k_h (MN/m³) *Mayerhof & Baike*
CII	2.2	2.2	20	18	23	2.4	0.4	1.12	30000	0.40	1.11
	3.5	1.3	20					2.05		0.77	2.04
	5.4	1.9	10								
siSa	8.3	2.9	10	30	5	13.5	0.3	10.03		3.94	9.18
	10.6	2.3	10					4.90		1.81	4.49
	15.1	4.5	10					14.99		5.77	13.01
SaP	22.3	7.2	10	33	7	32.3	0.2	29.03		11.81	25.20

Table 14. – Overview of adopted soil parameters for pillar site IV

Layer designation	z (m)	d (m)	γ (kN/m³)	φ (°)	c (kN/m²)	Mv (MN/m²)	ν	E_s (MN/m²)	E_p (MN/m²)	k_h (MN/m³) *Vesić*	k_h (MN/m³) *Mayerhof & Baike*
CII	2.2	2.2	20	18	23	2.4	0.4	1.12	30000	0.40	1.11
	3.5	1.3	20					2.05		0.77	2.04
	5.2	1.7	10								
siSa	8.3	3.1	10	30	5	13.5	0.3	10.03		3.94	9.18
	10.6	2.3	10					4.90		1.81	4.49
	14.6	4.0	10					14.99		5.77	13.01
SaP	22.4	7.8	10	33	7	32.3	0.2	29.03		11.81	25.20

Table 15.– Overview of adopted soil parameters for pillar site V

Layer designation	z (m)	d (m)	γ (kN/m³)	φ (°)	c (kN/m²)	Mv (MN/m²)	ν	E_s (MN/m²)	E_p (MN/m²)	k_h (MN/m³) *Vesić*	k_h (MN/m³) *Mayerhof & Baike*
CII	2.6	2.6	20	18	23	2.4	0.4	1.12	30000	0.40	1.11
	3.6	1.0	20					2.05		0.77	2.04
	4.2	0.6	10								
siSa	8.5	4.3	10	30	5	13.5	0.3	10.03		3.94	9.18
	10.8	2.3	10					4.90		1.81	4.49
	14.2	3.4	10					14.99		5.77	13.01
SaP	22.5	8.3	10	33	7	32.3	0.2	29.03		11.81	25.20

Table 16.– Overview of adopted soil parameters for pillar site VI

Layer designation	z (m)	d (m)	γ (kN/m³)	φ (°)	c (kN/m²)	Mv (MN/m²)	ν	E_s (MN/m²)	E_p (MN/m²)	k_h (MN/m³) *Vesić*	k_h (MN/m³) *Mayerhof & Baike*
CII	2.4	2.4	20	18	23	2.4	0.4	1.12	30000	0.40	1.11
	3.4	1.0	20					2.05		0.77	2.04
	4.0	0.6	10								
siSa	8.4	4.4	10	30	5	13.5	0.3	10.03		3.94	9.18
	10.7	2.3	10					4.90		1.81	4.49
	13.4	2.7	10					14.99		5.77	13.01
SaP	22.5	9.1	10	33	7	32.3	0.2	29.03		11.81	25.20

Table 17.– Overview of adopted soil parameters for pillar site VII

Layer designation	z (m)	d (m)	γ (kN/m³)	φ (°)	c (kN/m²)	Mv (MN/m²)	ν	E_s (MN/m²)	E_p (MN/m²)	k_h (MN/m³) *Vesić*	k_h (MN/m³) *Mayerhof & Baike*
CII	2.2	2.2	20	18	23	2.4	0.4	1.12	30000	0.40	1.11
	3.1	0.9	10					2.05		0.77	2.04
siSa	8.2	5.1	10	30	5	13.5	0.3	10.03		3.94	9.18
	10.5	2.3	10					4.90		1.81	4.49
	12.8	2.3	10					14.99		5.77	13.01
SaP	22.3	9.5	10	33	7	32.3	0.2	29.03		11.81	25.20

Table 18.– Overview of adopted soil parameters for pillar site VIII

Layer designation	z (m)	d (m)	γ (kN/m³)	φ (°)	c (kN/m²)	Mv (MN/m²)	ν	E_s (MN/m²)	E_p (MN/m²)	k_h (MN/m³) *Vesić*	k_h (MN/m³) *Mayerhof & Baike*
CII	3.0	3.0	20	18	23	2.4	0.4	1.12	30000	0.40	1.11
	3.8	0.8	10					2.05		0.77	2.04
	4.0	0.2	10								
siSa	9.0	5.0	10	30	5	13.5	0.3	10.03		3.94	9.18
	11.3	2.3	10					4.90		1.81	4.49
	13.2	1.9	10					14.99		5.77	13.01
SaP	23.0	9.8	10	33	7	32.3	0.2	29.03		11.81	25.20

Table 20. - Review of the results of bearing capacity and settlement analysis of individual piles and groups of piles

Pillar site	Length of pile	Diameter of pile	Analysis results SRPS EN 1997-1, DA2			Settlement of pile group
	L_s (m)	d (m)	$R_{s;d}$ (kN)	$R_{b;d}$ (kN)	$R_{c;d}$ (kN)	s (mm)
S1	10.0	1.2	1672.40	1546.35	3218.75	
	11.0	1.2	1954.28	1649.16	3603.44	
	12.0	1.2	2256.80	2978.37	5235.18	
	13.0	1.2	2639.45	3153.15	5792.60	
	14.0	1.2	3043.90	3327.94	6371.85	
	15.0	1.2	3470.18	3502.73	6972.91	
	16.0	1.2	3918.27	3677.51	7595.78	
	17.0	1.2	4388.17	3852.30	8240.47	
	18.0	1.2	4879.89	4027.09	8906.98	
	19.0	1.2	5393.43	4201.87	9595.30	
	20.0	1.2	5928.78	4376.66	10305.44	
S2	10.0	1.2	1748.85	1583.36	3065.64	
	11.0	1.2	2037.26	1686.18	3425.57	
	12.0	1.2	2343.82	3041.29	4954.30	
	13.0	1.2	2734.31	3216.08	5474.36	
	14.0	1.2	3146.62	3390.86	6014.49	
	15.0	1.2	3580.75	3565.65	6574.69	
	16.0	1.2	4036.69	3740.44	7154.96	
	17.0	1.2	4514.45	3915.22	7755.30	
	18.0	1.2	5014.02	4090.01	8375.71	
	19.0	1.2	5535.41	4264.80	9016.19	
	20.0	1.2	6078.62	4439.58	9676.75	
S3	10.0	1.2	1842.79	1643.00	3206.93	
	11.0	1.2	2141.73	1745.81	3576.54	
	12.0	1.2	2458.80	1848.63	3962.83	
	13.0	1.2	2820.26	3317.45	5646.70	
	14.0	1.2	3245.23	3492.24	6198.47	
	15.0	1.2	3692.01	3667.03	6770.31	
	16.0	1.2	4160.60	3841.81	7362.22	
	17.0	1.2	4651.01	4016.60	7974.21	
	18.0	1.2	5163.24	4191.39	8606.26	

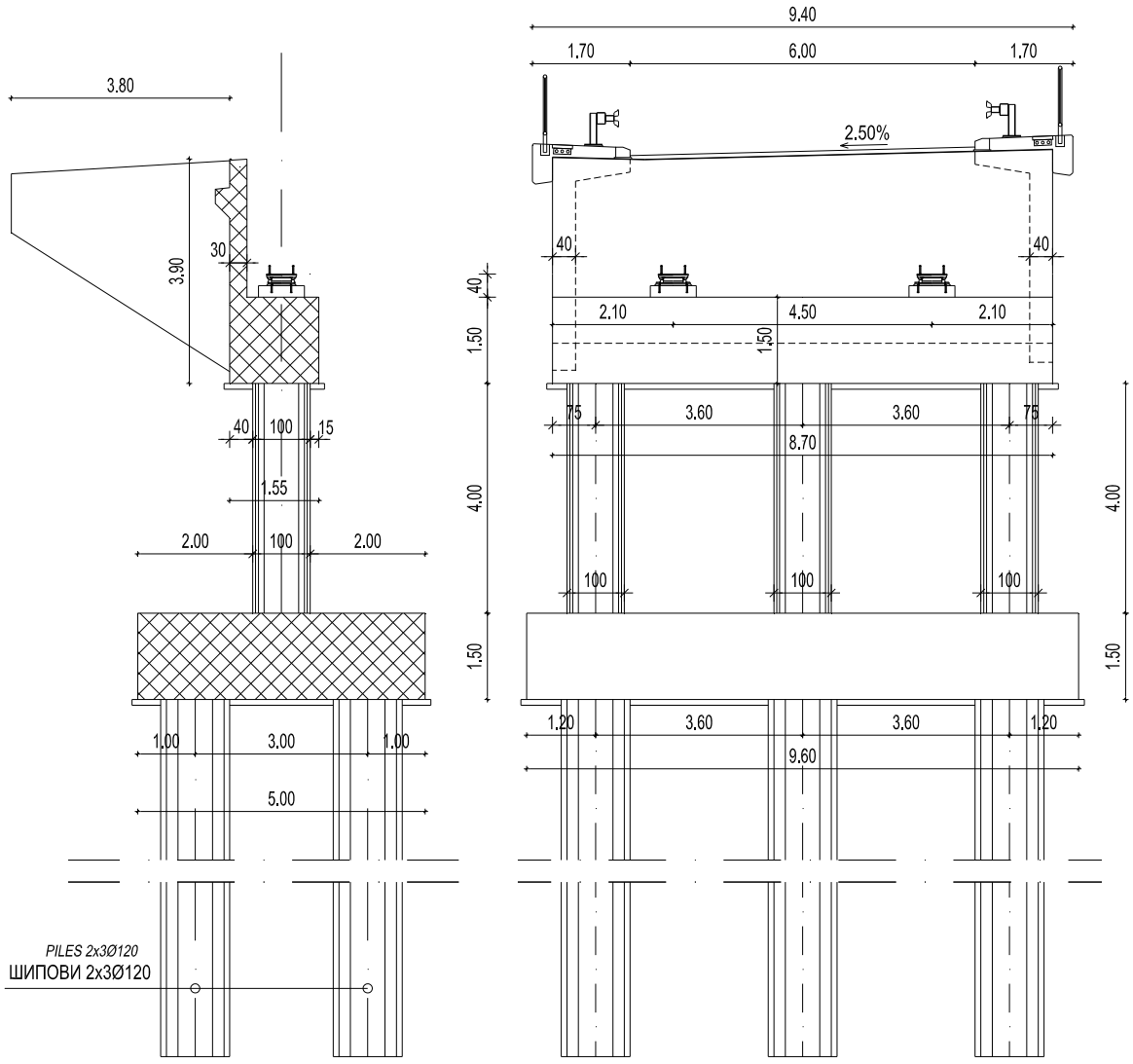
Pillar site	Length of pile	Diameter of pile	Analysis results SRPS EN 1997-1, DA2			Settlement of pile group
	L_s (m)	d (m)	$R_{s;d}$ (kN)	$R_{b;d}$ (kN)	$R_{c;d}$ (kN)	s (mm)
	19.0	1.2	5697.28	4366.17	9258.38	
	20.0	1.2	6253.14	4540.96	9930.57	
S4	10.0	1.2	1722.11	1573.08	3031.58	
	11.0	1.2	2008.71	1675.90	3389.84	
	12.0	1.2	2313.45	1778.71	3764.79	
	13.0	1.2	2649.71	3198.60	5380.60	
	14.0	1.2	3059.84	3373.39	5918.56	
	15.0	1.2	3491.78	3548.17	6476.76	
	16.0	1.2	3945.54	3722.96	7055.02	
	17.0	1.2	4421.12	3897.75	7653.36	
	18.0	1.2	4918.51	4072.53	8271.76	
	19.0	1.2	5437.72	4247.32	8910.23	
	20.0	1.2	5978.74	4422.11	9568.78	
S5	10.0	1.2	1880.27	1624.49	3224.38	
	11.0	1.2	2175.94	1727.30	3590.99	
	12.0	1.2	2489.75	3111.20	5152.88	
	13.0	1.2	2888.97	3285.99	5680.97	
	14.0	1.2	3310.01	3460.78	6229.13	
	15.0	1.2	3752.86	3635.57	6797.35	
	16.0	1.2	4217.53	3810.35	7685.65	
	17.0	1.2	4704.02	3985.14	7994.02	
	18.0	1.2	5212.31	4159.93	8622.46	
	19.0	1.2	5742.43	4334.71	9270.97	
	20.0	1.2	6294.36	4509.50	9939.55	
S6	10.0	1.2	1943.44	1655.33	3329.27	
	11.0	1.2	2283.24	2988.85	4850.33	
	12.0	1.2	2667.19	3163.64	5364.37	
	13.0	1.2	3072.96	3338.43	5898.48	
	14.0	1.2	3500.54	3513.21	6452.65	
	15.0	1.2	3949.94	3688.00	7026.90	
	16.0	1.2	4421.15	3862.79	7621.22	
	17.0	1.2	4914.18	4037.57	8235.61	
	18.0	1.2	5429.02	4212.36	8870.08	
	19.0	1.2	3553.60	3443.30	6437.15	
	20.0	1.2	6524.16	4561.94	10199.21	
S7	10.0	1.2	1774.06	1531.95	3041.54	
	11.0	1.2	2053.41	2779.11	4445.91	
	12.0	1.2	2411.18	2953.90	4935.87	
	13.0	1.2	2790.77	3128.68	5445.89	
	14.0	1.2	3192.17	3303.47	5975.99	
	15.0	1.2	3615.39	3478.26	6526.16	
	16.0	1.2	4060.43	3653.04	7096.39	
	17.0	1.2	4527.28	3827.83	7686.70	
	18.0	1.2	5015.94	4002.62	8297.07	
	19.0	1.2	5526.42	4177.40	8927.52	
	20.0	1.2	6058.72	4352.19	9578.04	

Pillar site	Length of pile	Diameter of pile	Analysis results SRPS EN 1997-1, DA2			Settlement of pile group
	L_s (m)	d (m)	$R_{s;d}$ (kN)	$R_{b;d}$ (kN)	$R_{c;d}$ (kN)	s (mm)
S8	10.0	1.2	1800.67	1583.36	3384.03	
	11.0	1.2	2089.08	1686.18	3775.26	
	12.0	1.2	2420.93	3041.29	5462.22	
	13.0	1.2	2811.42	3216.08	6027.50	
	14.0	1.2	3223.74	3390.86	6614.60	
	15.0	1.2	3657.86	3565.65	7223.51	
	16.0	1.2	4113.81	3740.44	7854.24	
	17.0	1.2	4591.56	3915.22	8506.79	
	18.0	1.2	5091.14	4090.01	9181.15	
	19.0	1.2	5612.53	4264.80	9877.32	
	20.0	1.2	6155.73	4439.58	10595.31	

4.7. ОБАЛНИ СТУБ

ABUTMENT

4.7.1 **Диспозиција /** General arrangement



Подужни пресек / longitudinal section **Попречни пресек /** cross section

4.7.2 Анализа оптерецења / Load analyses

4.7.2.1 Сопствена тежина / Self weight

Сопствена тежина свих елемената је узета у обзир у прорачуну аутоматски у програмском пакету.

Self weight of all elements will be taken into account automaticaly by design software.

Зид / Wall **,** d = 30 cm

Крило / Wing wall **,** d = 40 cm

Лежишна греда / Bearing beam , d/b = 150/145 cm

Стуб / Column , Φ100 cm

Темељ / Foundation , d = 150 cm

Шипови / Piles **,** Φ120 cm

4.7.2.2 Стално оптерећење / Dead load

Лежишна греда / Bearing beam

R1 = 0.90 x 1.00 x 8.70 x 25.0 / 2 = 98 kN

Монтажни носач / pre-cast girder

R1 = 68 kN →∑R = 68x10 = 680 kN → Rg = 680/2 = 340 kN

Коловозна плоча / Deck

R1 = 37 kN →∑R = 37x10 = 370 kN → Rg = 370/2 = 185 kN

Укупно / total Rg = 623 kN

4.7.2.3 Додатно стално оптерећење / Superimposed load

Разматрана су следећа оптерећења / The following loads are considered :

- **Асфалт /**Asphalt
- **Хидроизолација /** Waterproofing
- **Пешачка стаза** / Foot path
- **Ивичњак /** Curb
- **Ел. Одбојна ограда /** Steel safety barrier
- **Пешачка ограда** / railing

Реакције преузете из RM софтвера / Reactions taken from RM software

R1 = 118 kN

R2 = 118 kN

4.7.2.4 Притисак тла / Earth pressure

Притисак тла у миру / earth pressure at rest

pzh = (1-sinφ) x γ x h = ko x γ x h

φ = 35

Прорачун по ULS-u / Design at ULS

tan φd = tanφk/γ_{φ} = tan35/1.25 = 0.46

φd = arctan0.46 = 24.79°

ko = 1-sinφk = 0.581

γz = 20 kN/m3

Притисак на зид / pressure on the wall

h = 0.0 m → pzh = 0 kN/m2

h = 3.9 m → pzh = 0.581 x 20 x 3.9 = 45 kN/m2

Притисак на стуб / pressure on the column

Φ100 cm → 3Φ = 3 x 100 = 300 cm

Pzh = 45 x3.00 = 135 kN/m

4.7.2.5 Возило на објекту / Traffic load on the structure

Реакције преузете из RM софтвера / Reactions taken from RM software

TS

R1 = 538 kN

R2 = 416 kN

UDL

R1 = 181 kN

R2 = 88 kN

Укупно / total

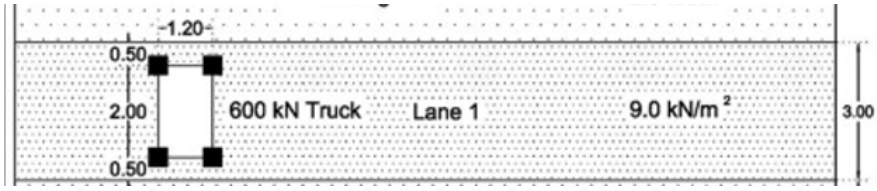
R1 = 538 +181 = 719 kN

R2 = 416 + 88 = 504 kN

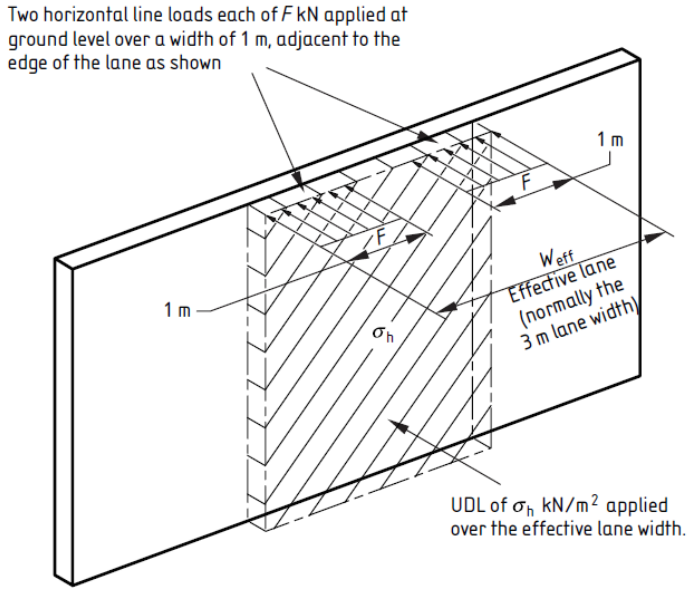
4.7.2.6 Возило на насипу / Traffic load on embankment

Двоосовински тандем систем (TS) концентрисаних сила / Tandem system (including two axles) (TS)

Прва трака / First lane Q_{1k}= 1.0 x 2 x 300 kN= 600 kN



Распростирање оптерећења / Load distribution



F = 330 x ko x Lf = 330 x 0.581 x 1.0 = 192 kN/m

σ = 20 x ko x R x Lf , ko = 0.581 , R = 3.0/w = 1.0 , Lf = 1.0

σ = 20 x 0.581 x 1.0 x 1.0 = 6.75 kN/m2

4.7.3 **Статички модел /** Static model

Table of materials

No	Material name	E[kN/m2]	μ	γ[kN/m3]	αt[1/C]	Em[kN/m2]	μm
1	Beton C 30	3.150e+7	0.20	25.00	1.000e-5	3.150e+7	0.20

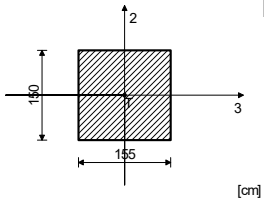
Slab sets

No	t[m]	e[m]	Material	Analysis type	Orthotropy	E2[kN/m2]	G[kN/m2]	α
<1>	0.300	0.150	1	Thin slab	Isotrophy			
<2>	0.300	0.150	1	Thin slab	Isotrophy			
<3>	1.200	0.600	1	Thin slab	Isotrophy			
<4>	0.400	0.200	1	Thin slab	Isotrophy			

Beam sets

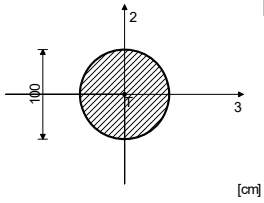
Set: 1 Section: b/d=155/150, Approx. eccentricity

Mat.	A1	A2	A3	I1	I2	I3
1 - Beton C 30	2.325e+0	1.938e+0	1.938e+0	7.583e-1	4.655e-1	4.359e-1



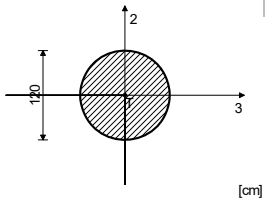
Set: 2 Section: D=100, Approx. eccentricity

Mat.	A1	A2	A3	I1	I2	I3
1 - Beton C 30	7.854e-1	7.069e-1	7.069e-1	9.817e-2	4.909e-2	4.909e-2



Set: 3 Section: D=120, Approx. eccentricity

Mat.	A1	A2	A3	I1	I2	I3
1 - Beton C 30	1.131e+0	1.018e+0	1.018e+0	2.036e-1	1.018e-1	1.018e-1

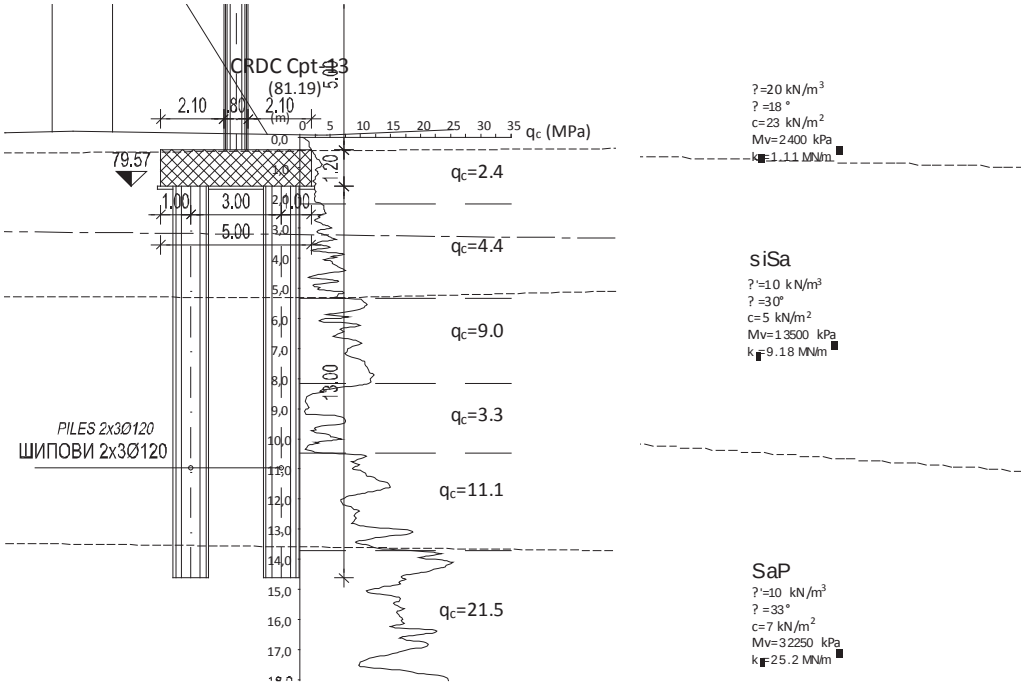


Point support sets

Set	K,R1	K,R2	K,R3	K,M1	K,M2	K,M3
1	5.000e+4	5.000e+4	1.000e+6			

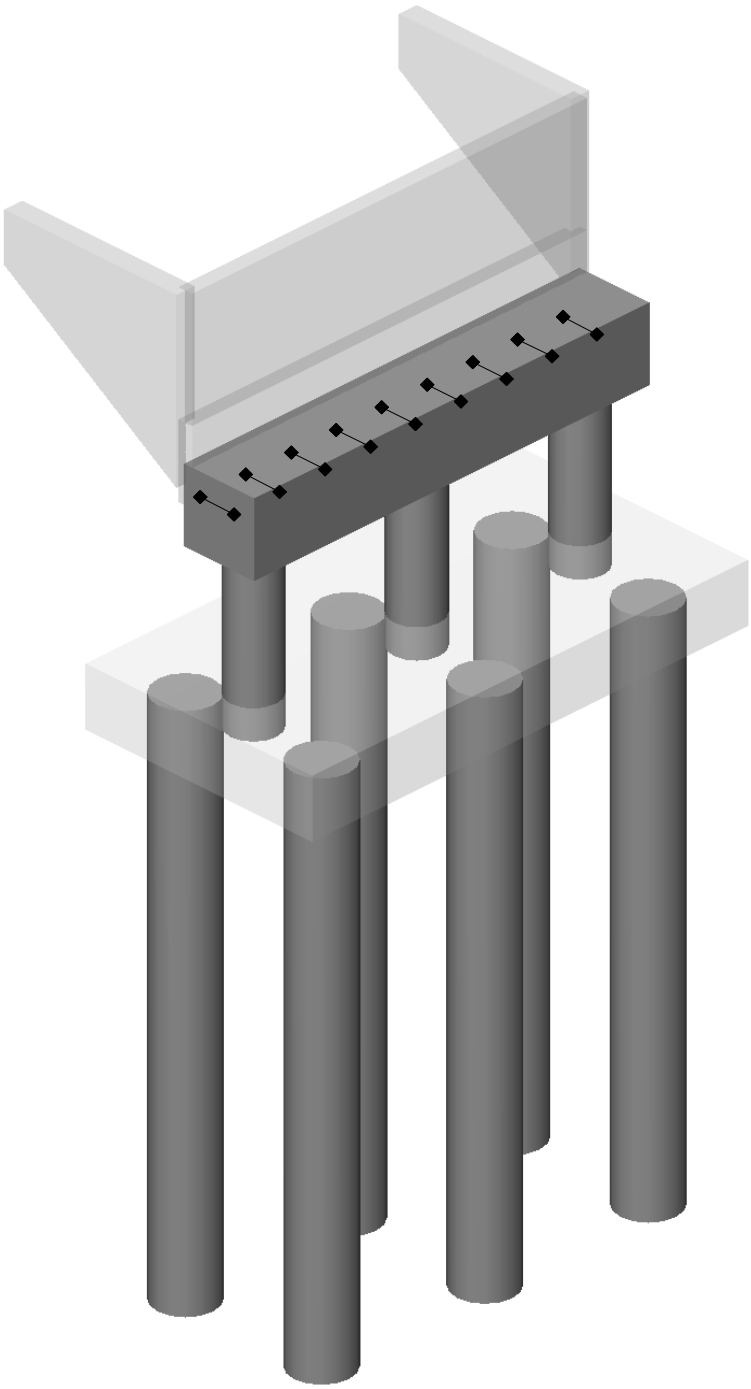
Linear support sets

Set	K,R1	K,R2	K,R3	K,M1	Soil [m]
1		1.330e+3	1.330e+3		
2		1.100e+4	1.100e+4		
3		3.200e+4	3.200e+4		



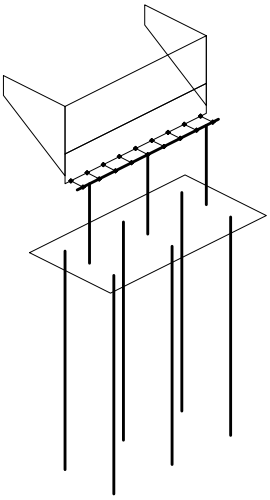
Linear support sets (Dynamic analysis)

Set	K,R1	K,R2	K,R3	K,M1	Soil [m]
4		2.660e+3	2.660e+3		
5		2.200e+4	2.200e+4		
6		6.400e+4	6.400e+4		

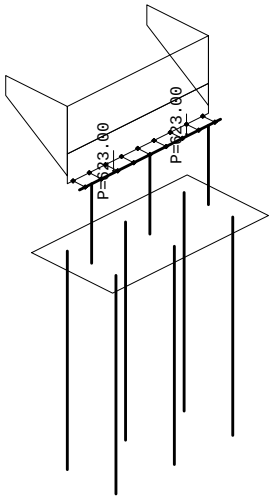


Isometric

4.7.4 **Оптерећења /** Loads

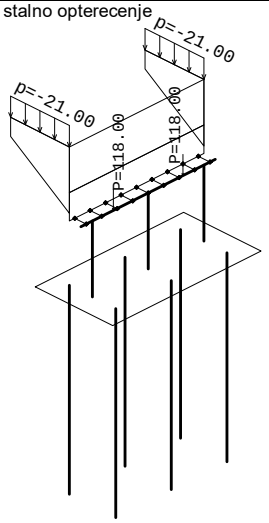

Isometric

Load 2: Stalno opterecenje



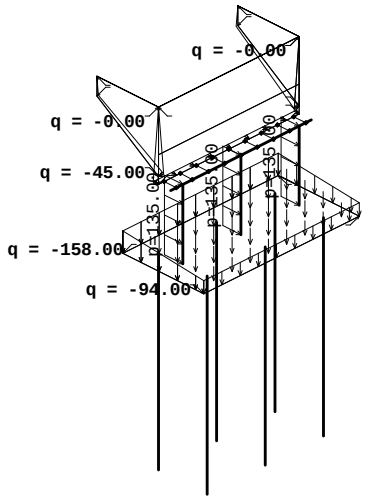
Isometric

Load 3: Dodatno stalno opterecenje



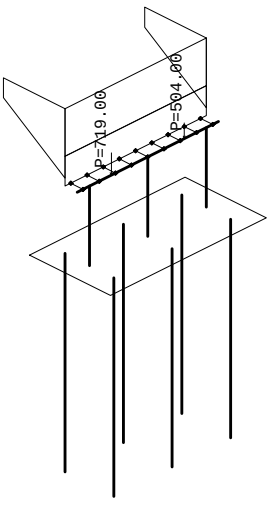
Isometric

Load 4: Pritisak tla



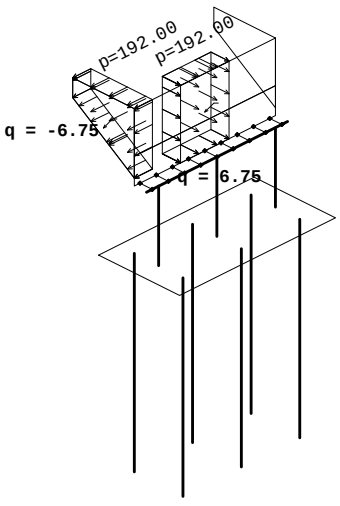
Isometric

Load 5: Vozilo na objektu



Isometric

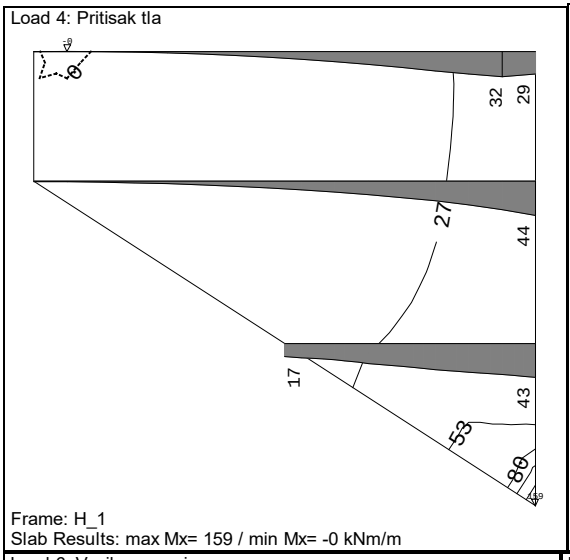
Load 6: Vozilo na nasipu

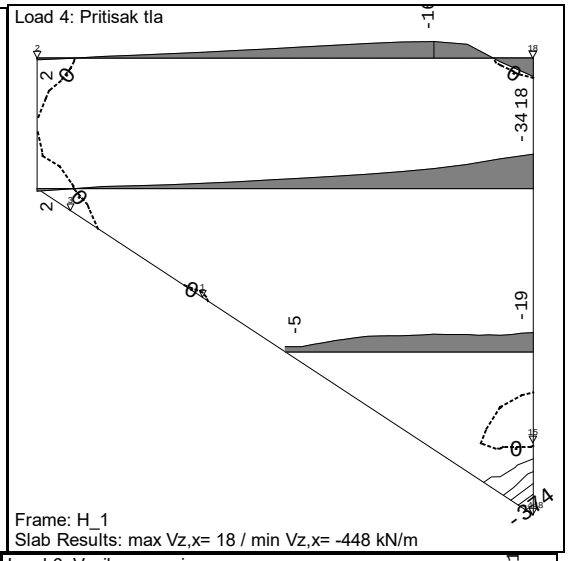


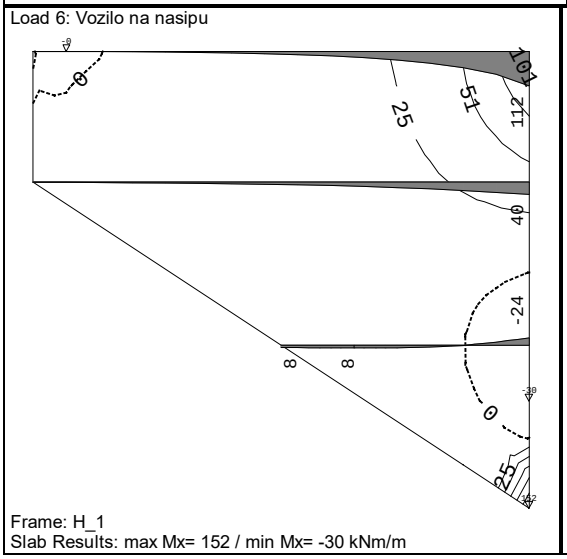
Isometric

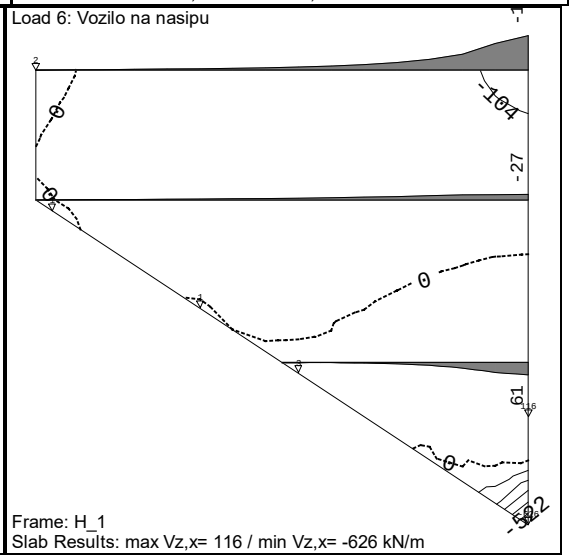
4.7.5 **Пресечне силе и деформације /** Internal forces and deformations

4.7.5.1 **Крило/** Wing wall



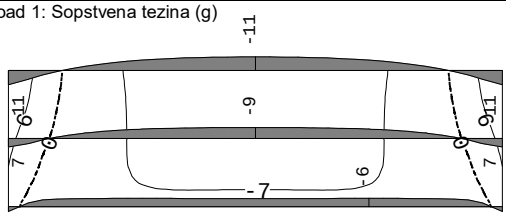






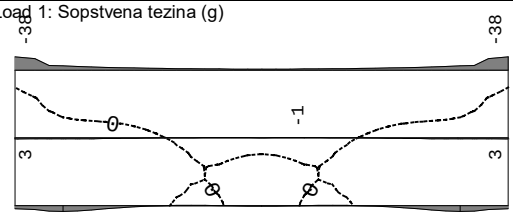
4.7.5.2 Зид/ Wall

Load 1: Sopstvena tezina (g)



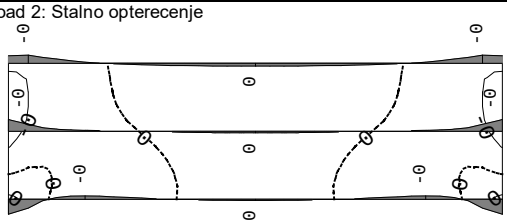
Frame: V_1
Slab Results: max Mx= 17 / min Mx= -27 kNm/m

Load 1: Sopstvena tezina (g)



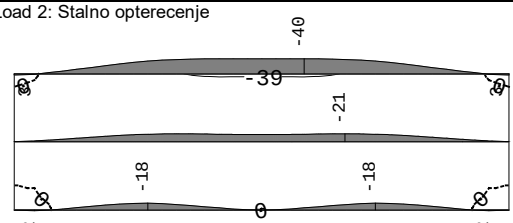
Frame: V_1
Slab Results: max Nx= 75 / min Nx= -228 kN/m

Load 2: Stalno opterecenje



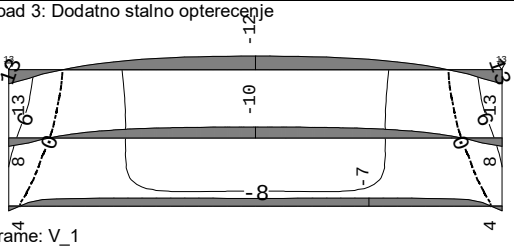
Frame: V_1
Slab Results: max Mx= 1 / min Mx= -0 kNm/m

Load 2: Stalno opterecenje



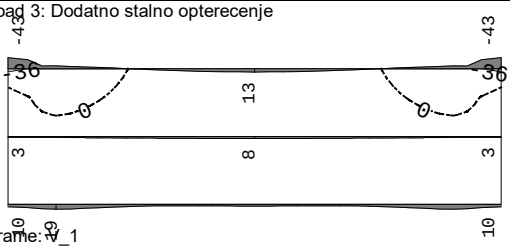
Frame: V_1
Slab Results: max Nx= 136 / min Nx= -154 kN/m

Load 3: Dodatno stalno opterecenje



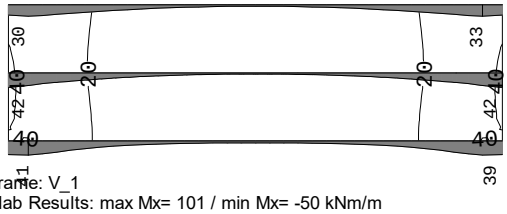
Frame: V_1
Slab Results: max Mx= 19 / min Mx= -31 kNm/m

Load 3: Dodatno stalno opterecenje



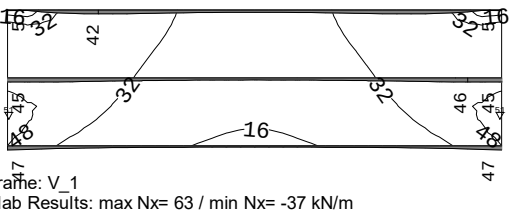
Frame: V_1
Slab Results: max Nx= 50 / min Nx= -178 kN/m

Load 4: Pritisak tla



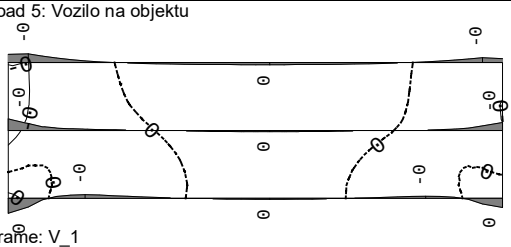
Frame: V_1
Slab Results: max Mx= 101 / min Mx= -50 kNm/m

Load 4: Pritisak tla



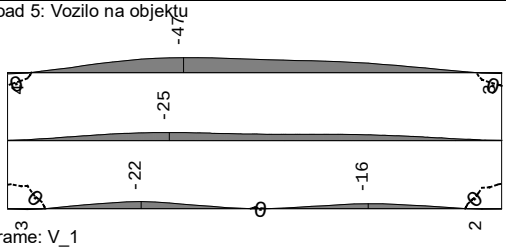
Frame: V_1
Slab Results: max Nx= 63 / min Nx= -37 kN/m

Load 5: Vozilo na objektu



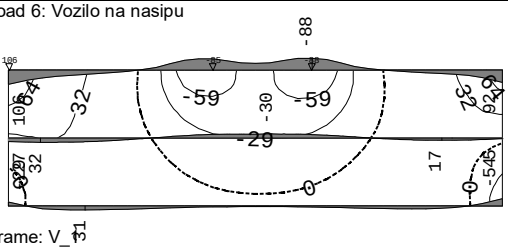
Frame: V_1
Slab Results: max Mx= 1 / min Mx= -0 kNm/m

Load 5: Vozilo na objektu



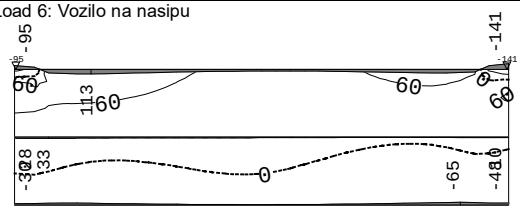
Frame: V_1
Slab Results: max Nx= 173 / min Nx= -191 kN/m

Load 6: Vozilo na nasipu



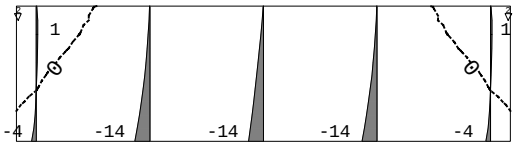
Frame: V_1
Slab Results: max Mx= 128 / min Mx= -88 kNm/m

Load 6: Vozilo na nasipu



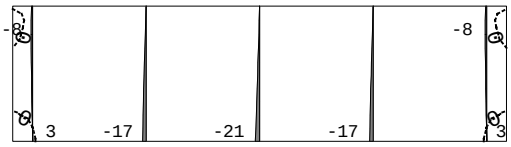
Frame: V_1
Slab Results: max Nx= 298 / min Nx= -146 kN/m

Load 1: Sopstvena tezina (g)



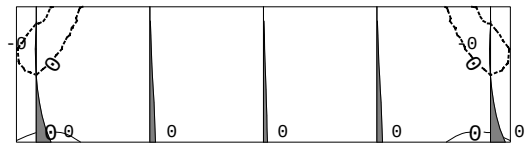
Frame: V_1
Slab Results: max My= 2 / min My= -108 kNm/m

Load 1: Sopstvena tezina (g)



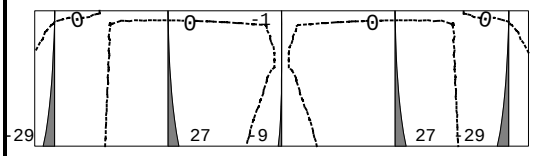
Frame: V_1
Slab Results: max Ny= 174 / min Ny= -451 kN/m

Load 2: Stalno opterecenje



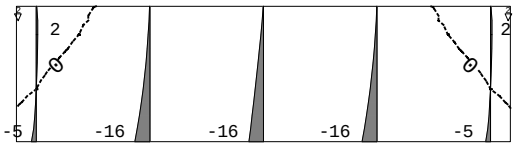
Frame: V_1
Slab Results: max My= 1 / min My= -1 kNm/m

Load 2: Stalno opterecenje



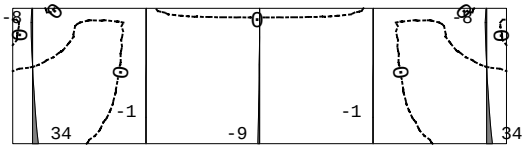
Frame: V_1
Slab Results: max Ny= 336 / min Ny= -327 kN/m

Load 3: Dodatno stalno opterecenje



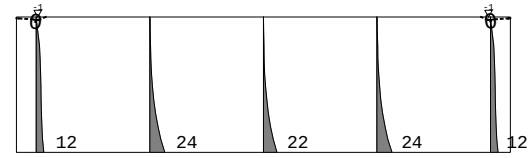
Frame: V_1
Slab Results: max My= 2 / min My= -123 kNm/m

Load 3: Dodatno stalno opterecenje



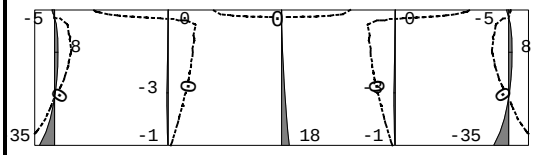
Frame: V_1
Slab Results: max Ny= 235 / min Ny= -276 kN/m

Load 4: Pritisak tla



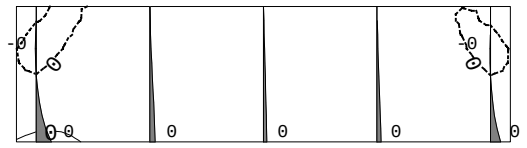
Frame: V_1
Slab Results: max My= 399 / min My= -1 kNm/m

Load 4: Pritisak tla



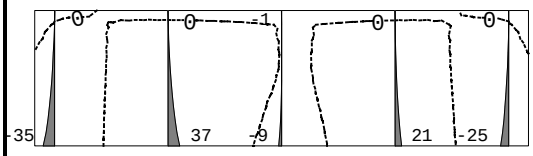
Frame: V_1
Slab Results: max Ny= 160 / min Ny= -278 kN/m

Load 5: Vozilo na objektu



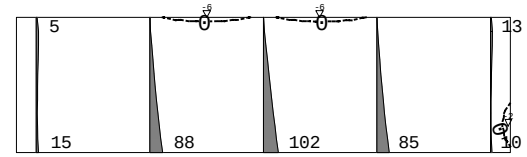
Frame: V_1
Slab Results: max My= 1 / min My= -1 kNm/m

Load 5: Vozilo na objektu



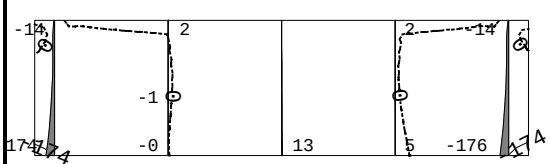
Frame: V_1
Slab Results: max Ny= 433 / min Ny= -402 kN/m

Load 6: Vozilo na nasipu



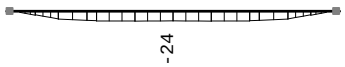
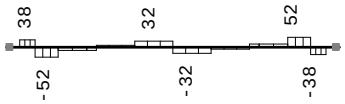
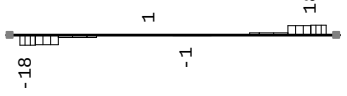
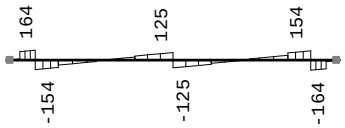
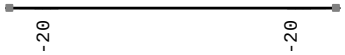
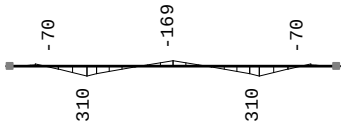
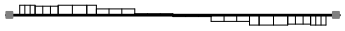
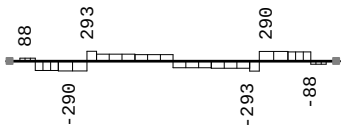
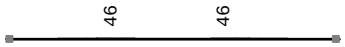
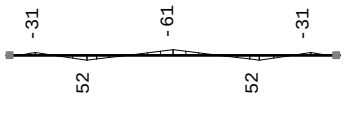
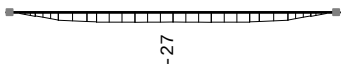
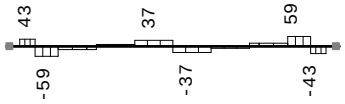
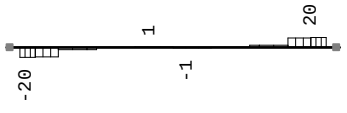
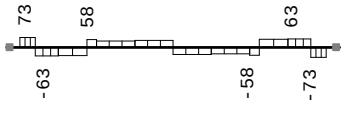
Frame: V_1
Slab Results: max My= 616 / min My= -6 kNm/m

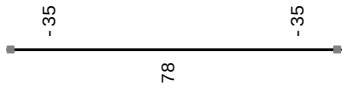
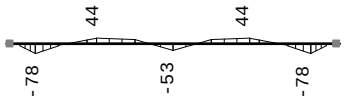
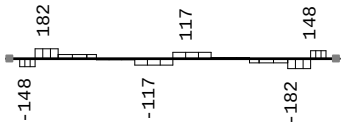
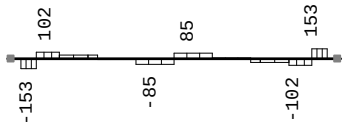
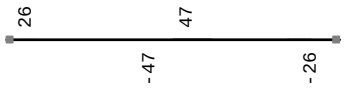
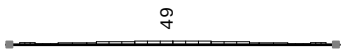
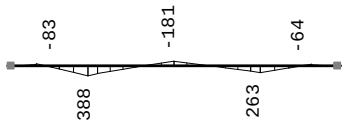
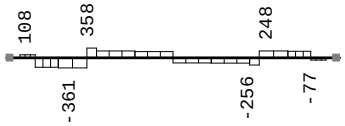
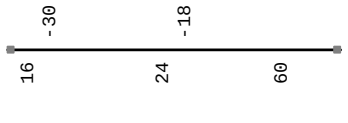
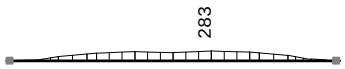
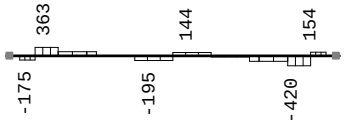
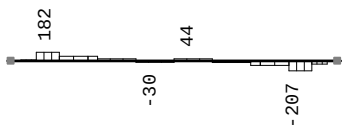
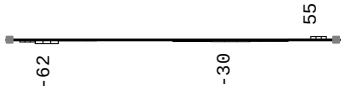
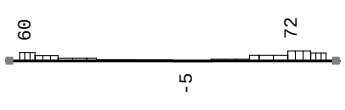
Load 6: Vozilo na nasipu



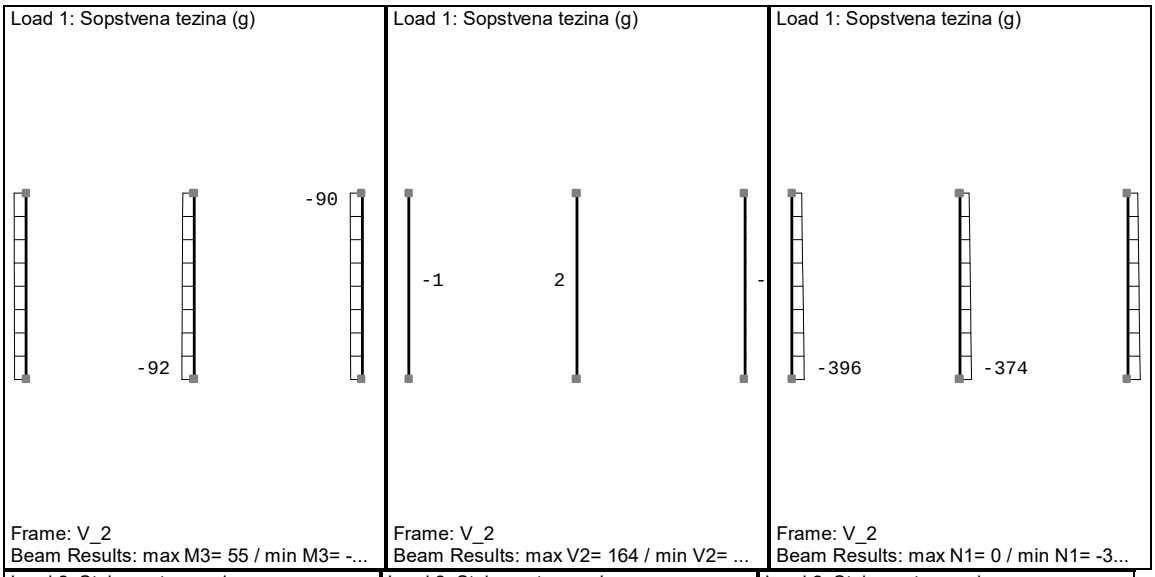
Frame: V_1
Slab Results: max Ny= 466 / min Ny= -868 kN/m

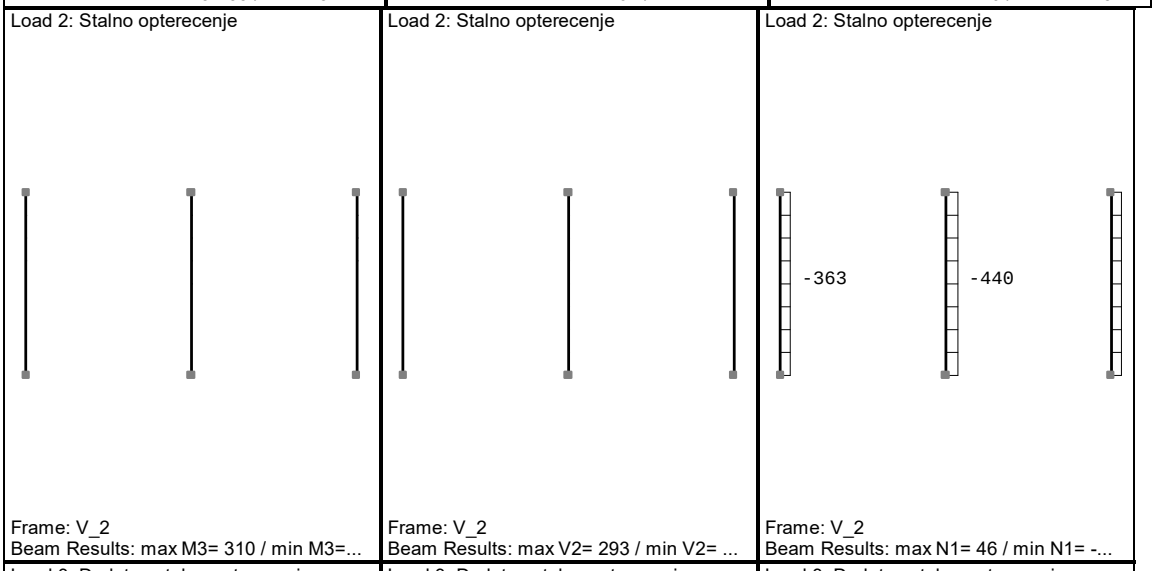
4.7.5.3 **Лежишна греда /** Bearing beam

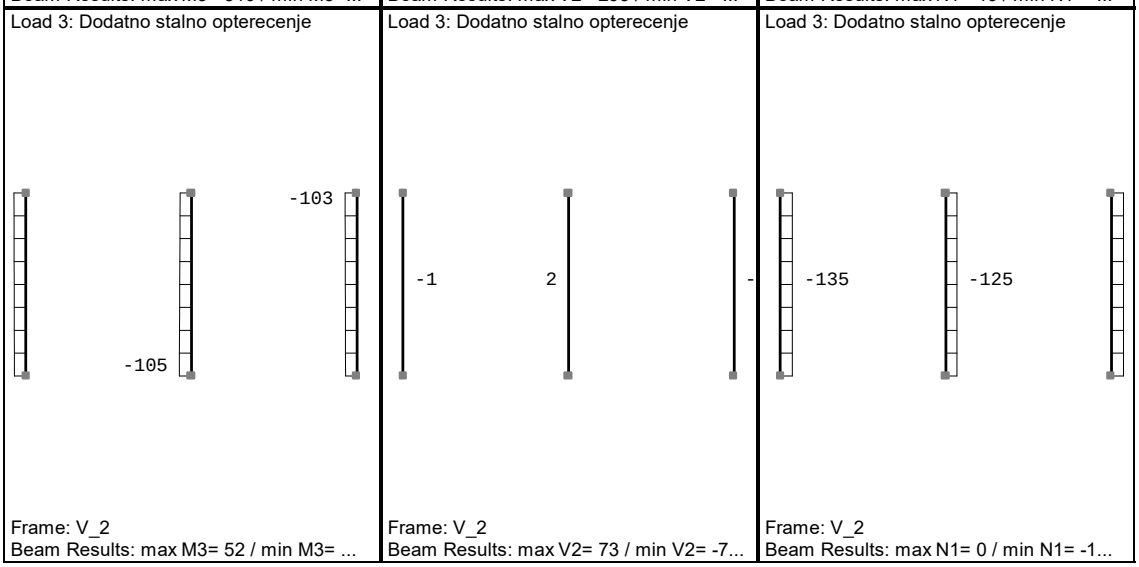
Load 1: Sopstvena tezina (g) Frame: V_2 Beam Results: max M3= 55 / min M3= -9...	Load 1: Sopstvena tezina (g)  Frame: V_2 Beam Results: max M2= 8 / min M2= -24...	Load 1: Sopstvena tezina (g)  Frame: V_2 Beam Results: max M1= 52 / min M1= -5...
Load 1: Sopstvena tezina (g)  Frame: V_2 Beam Results: max V3= 18 / min V3= -18 kN	Load 1: Sopstvena tezina (g)  Frame: V_2 Beam Results: max V2= 164 / min V2= -1...	Load 1: Sopstvena tezina (g)  Frame: V_2 Beam Results: max N1= 0 / min N1= -396 kN
Load 2: Stalno opterecenje  Frame: V_2 Beam Results: max M3= 310 / min M3= -1...	Load 2: Stalno opterecenje Frame: V_2 Beam Results: max M2= 30 / min M2= -3...	Load 2: Stalno opterecenje  Frame: V_2 Beam Results: max M1= 0 / min M1= -0 kNm
Load 2: Stalno opterecenje Frame: V_2 Beam Results: max V3= 11 / min V3= -11 kN	Load 2: Stalno opterecenje  Frame: V_2 Beam Results: max V2= 293 / min V2= -2...	Load 2: Stalno opterecenje  Frame: V_2 Beam Results: max N1= 46 / min N1= -44...
Load 3: Dodatno stalno opterecenje  Frame: V_2 Beam Results: max M3= 52 / min M3= -10...	Load 3: Dodatno stalno opterecenje  Frame: V_2 Beam Results: max M2= 2 / min M2= -28...	Load 3: Dodatno stalno opterecenje  Frame: V_2 Beam Results: max M1= 59 / min M1= -5...
Load 3: Dodatno stalno opterecenje  Frame: V_2 Beam Results: max V3= 20 / min V3= -20 kN	Load 3: Dodatno stalno opterecenje  Frame: V_2 Beam Results: max V2= 73 / min V2= -73 kN	Load 3: Dodatno stalno opterecenje Frame: V_2 Beam Results: max N1= 0 / min N1= -135 kN

Load 4: Pritisak tla  Frame: V_2 Beam Results: max M3= 2431 / min M3= -...	Load 4: Pritisak tla  Frame: V_2 Beam Results: max M2= 44 / min M2= -7...	Load 4: Pritisak tla  Frame: V_2 Beam Results: max M1= 182 / min M1= -1...
Load 4: Pritisak tla  Frame: V_2 Beam Results: max V3= 153 / min V3= -1...	Load 4: Pritisak tla  Frame: V_2 Beam Results: max V2= 47 / min V2= -79...	Load 4: Pritisak tla  Frame: V_2 Beam Results: max N1= 132 / min N1= -6...
Load 5: Vozilo na objektu  Frame: V_2 Beam Results: max M3= 388 / min M3= -1...	Load 5: Vozilo na objektu Frame: V_2 Beam Results: max M2= 34 / min M2= -2...	Load 5: Vozilo na objektu Frame: V_2 Beam Results: max M1= 0 / min M1= -0 kNm
Load 5: Vozilo na objektu Frame: V_2 Beam Results: max V3= 10 / min V3= -12 kN	Load 5: Vozilo na objektu  Frame: V_2 Beam Results: max V2= 358 / min V2= -3...	Load 5: Vozilo na objektu Frame: V_2 Beam Results: max N1= 55 / min N1= -46...
Load 6: Vozilo na nasipu  Frame: V_2 Beam Results: max M3= 1193 / min M3= -...	Load 6: Vozilo na nasipu  Frame: V_2 Beam Results: max M2= 283 / min M2= -4...	Load 6: Vozilo na nasipu  Frame: V_2 Beam Results: max M1= 363 / min M1= -4...
Load 6: Vozilo na nasipu  Frame: V_2 Beam Results: max V3= 182 / min V3= -2...	Load 6: Vozilo na nasipu  Frame: V_2 Beam Results: max V2= 55 / min V2= -16...	Load 6: Vozilo na nasipu  Frame: V_2 Beam Results: max N1= 72 / min N1= -28 kN

4.7.5.4 Стуб / Column







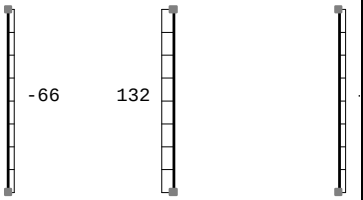
Load 4: Pritisak tla

Frame: V_2
Beam Results: max M3= 2431 / min M3...

Load 4: Pritisak tla

Frame: V_2
Beam Results: max V2= 47 / min V2= -...

Load 4: Pritisak tla



Frame: V_2
Beam Results: max N1= 132 / min N1= ...

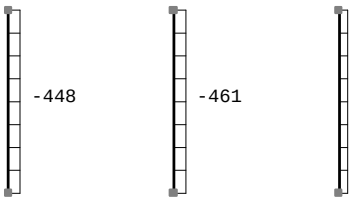
Load 5: Vozilo na objektu

Frame: V_2
Beam Results: max M3= 388 / min M3=...

Load 5: Vozilo na objektu

Frame: V_2
Beam Results: max V2= 358 / min V2= ...

Load 5: Vozilo na objektu

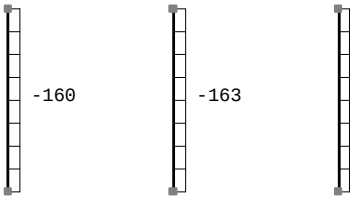


Frame: V_2
Beam Results: max N1= 55 / min N1= -...

Load 6: Vozilo na nasipu

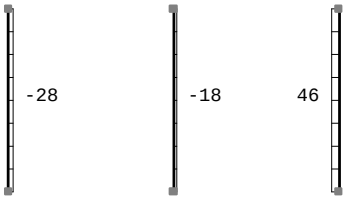
Frame: V_2
Beam Results: max M3= 1193 / min M3...

Load 6: Vozilo na nasipu



Frame: V_2
Beam Results: max V2= 55 / min V2= -...

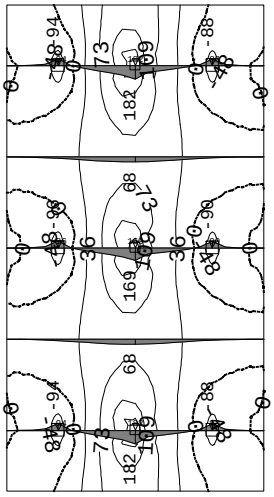
Load 6: Vozilo na nasipu



Frame: V_2
Beam Results: max N1= 72 / min N1= -...

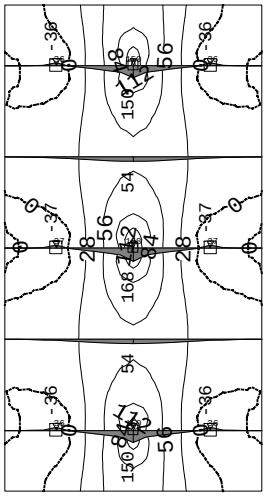
4.7.5.5 **Темељ /** Foundation

Load 1: Sopstvena tezina (g)



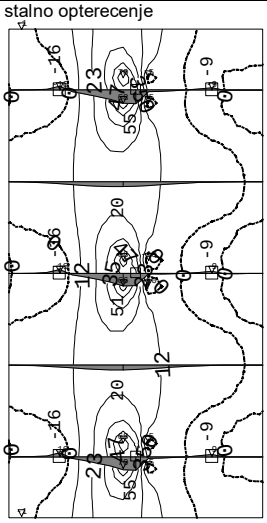
Level: [-7.90 m]
Slab Results: max Mx= 182 / min Mx= -96 kNm/m

Load 2: Stalno opterecenje



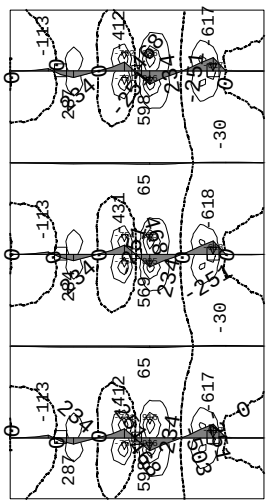
Level: [-7.90 m]
Slab Results: max Mx= 168 / min Mx= -37 kNm/m

Load 3: Dodatno stalno opterecenje



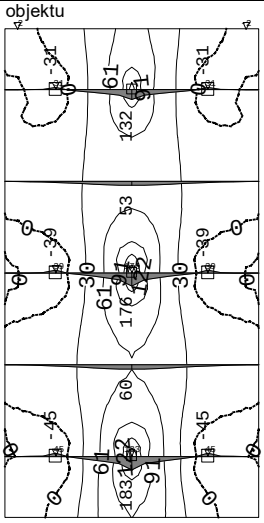
Level: [-7.90 m]
Slab Results: max Mx= 70 / min Mx= -16 kNm/m

Load 4: Pritisak tla



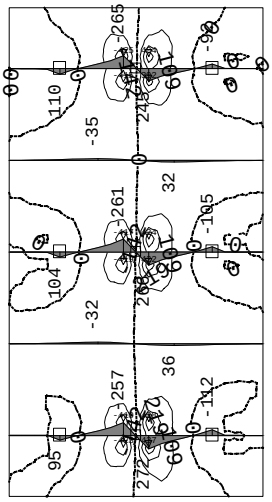
Level: [-7.90 m]
Slab Results: max Mx= 936 / min Mx= -754 kNm/m

Load 5: Vozilo na objektu



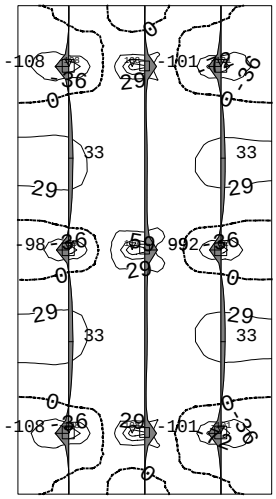
Level: [-7.90 m]
Slab Results: max Mx= 183 / min Mx= -45 kNm/m

Load 6: Vozilo na nasipu



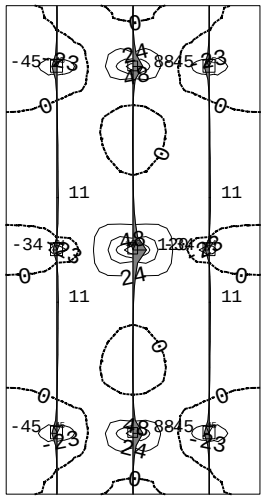
Level: [-7.90 m]
Slab Results: max Mx= 437 / min Mx= -425 kNm/m

Load 1: Sopstvena tezina (g)



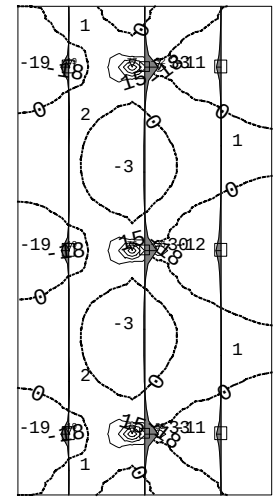
Level: [-7.90 m]
Slab Results: max My= 117 / min My= -108 kNm/m

Load 2: Stalno opterecenje



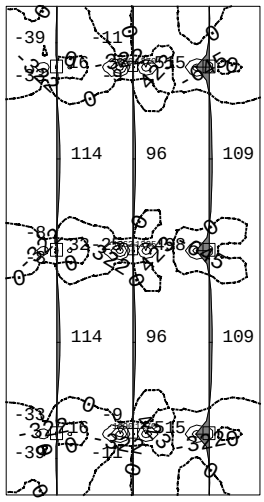
Level: [-7.90 m]
Slab Results: max My= 120 / min My= -45 kNm/m

Load 3: Dodatno stalno opterecenje



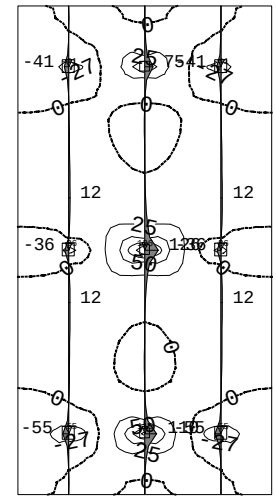
Level: [-7.90 m]
Slab Results: max My= 77 / min My= -36 kNm/m

Load 4: Pritisak tla



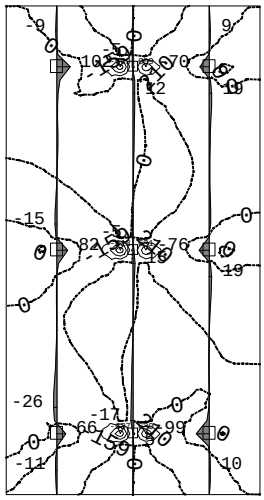
Level: [-7.90 m]
Slab Results: max My= 1270 / min My= -1290 kNm/m

Load 5: Vozilo na objektu



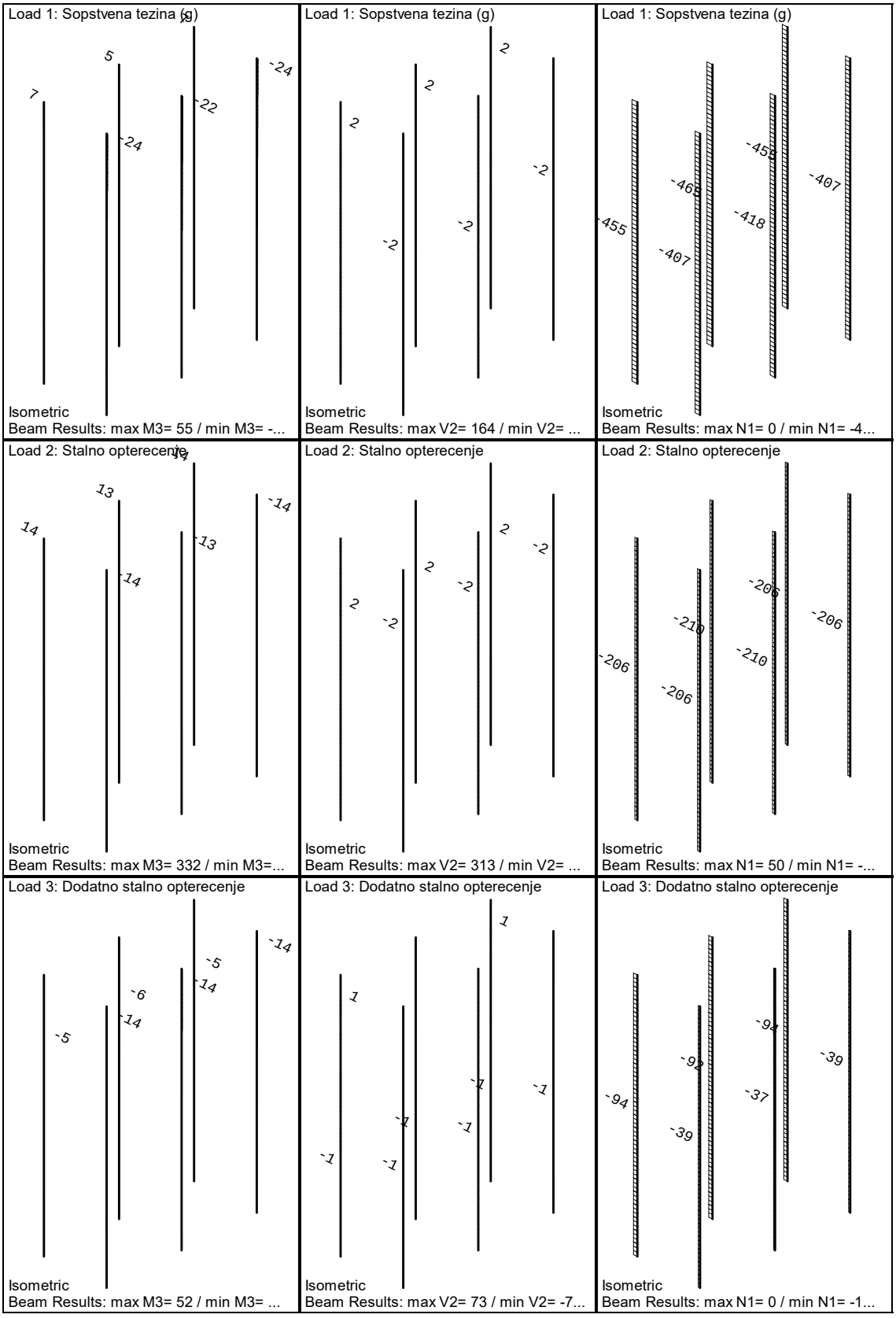
Level: [-7.90 m]
Slab Results: max My= 126 / min My= -55 kNm/m

Load 6: Vozilo na nasipu

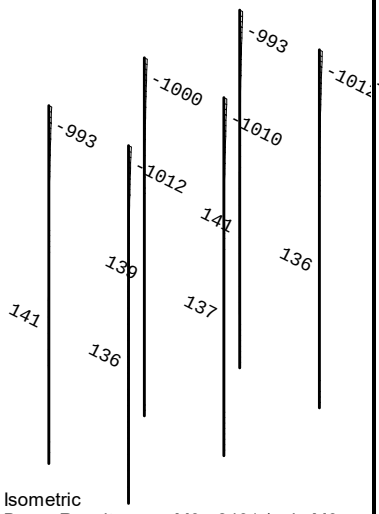


Level: [-7.90 m]
Slab Results: max My= 631 / min My= -637 kNm/m

4.7.5.6 Шипови / Piles



Load 4: Pritisak tla

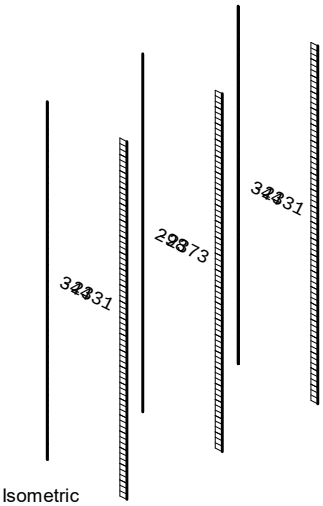


Isometric
Beam Results: max M3= 2431 / min M3...

Load 4: Pritisak tla

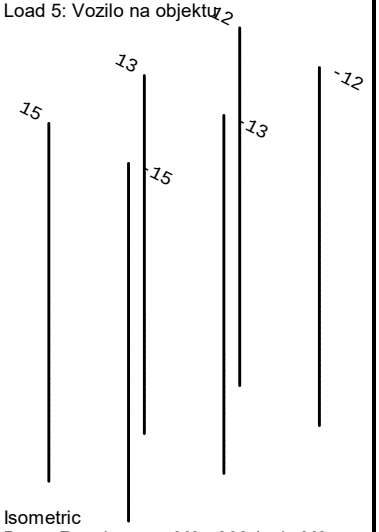
Isometric
Beam Results: max V2= 48 / min V2= -...

Load 4: Pritisak tla



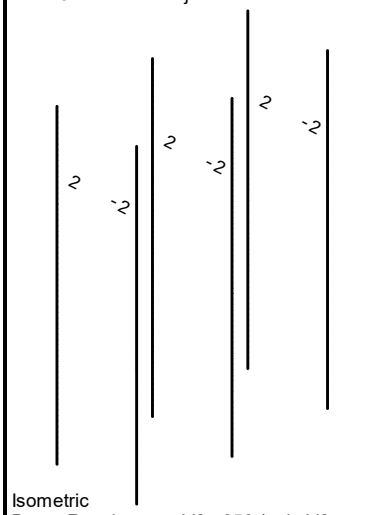
Isometric
Beam Results: max N1= 344 / min N1= ...

Load 5: Vozilo na objektu



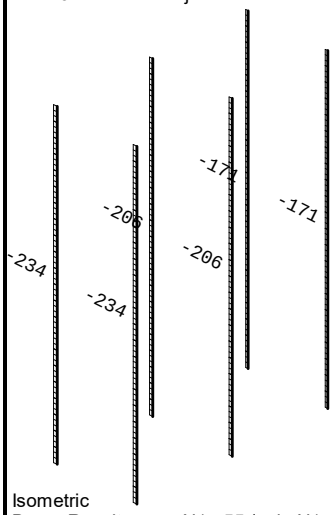
Isometric
Beam Results: max M3= 388 / min M3=...

Load 5: Vozilo na objektu



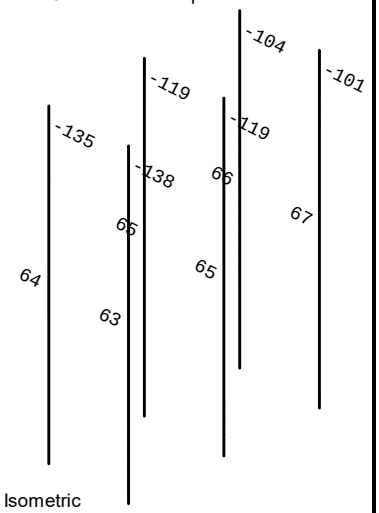
Isometric
Beam Results: max V2= 358 / min V2= ...

Load 5: Vozilo na objektu



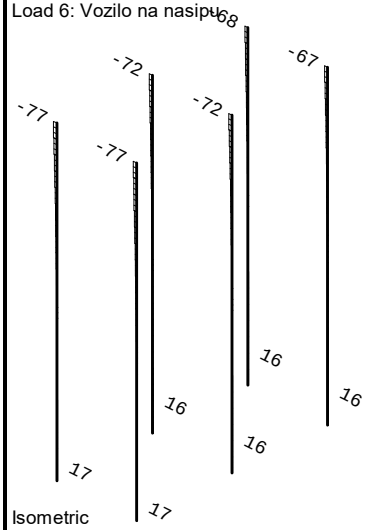
Isometric
Beam Results: max N1= 55 / min N1= -...

Load 6: Vozilo na nasipu



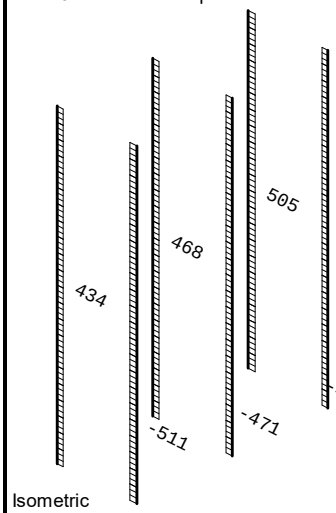
Isometric
Beam Results: max M3= 1193 / min M3...

Load 6: Vozilo na nasipu



Isometric
Beam Results: max V2= 55 / min V2= -...

Load 6: Vozilo na nasipu



Isometric
Beam Results: max N1= 505 / min N1= ...

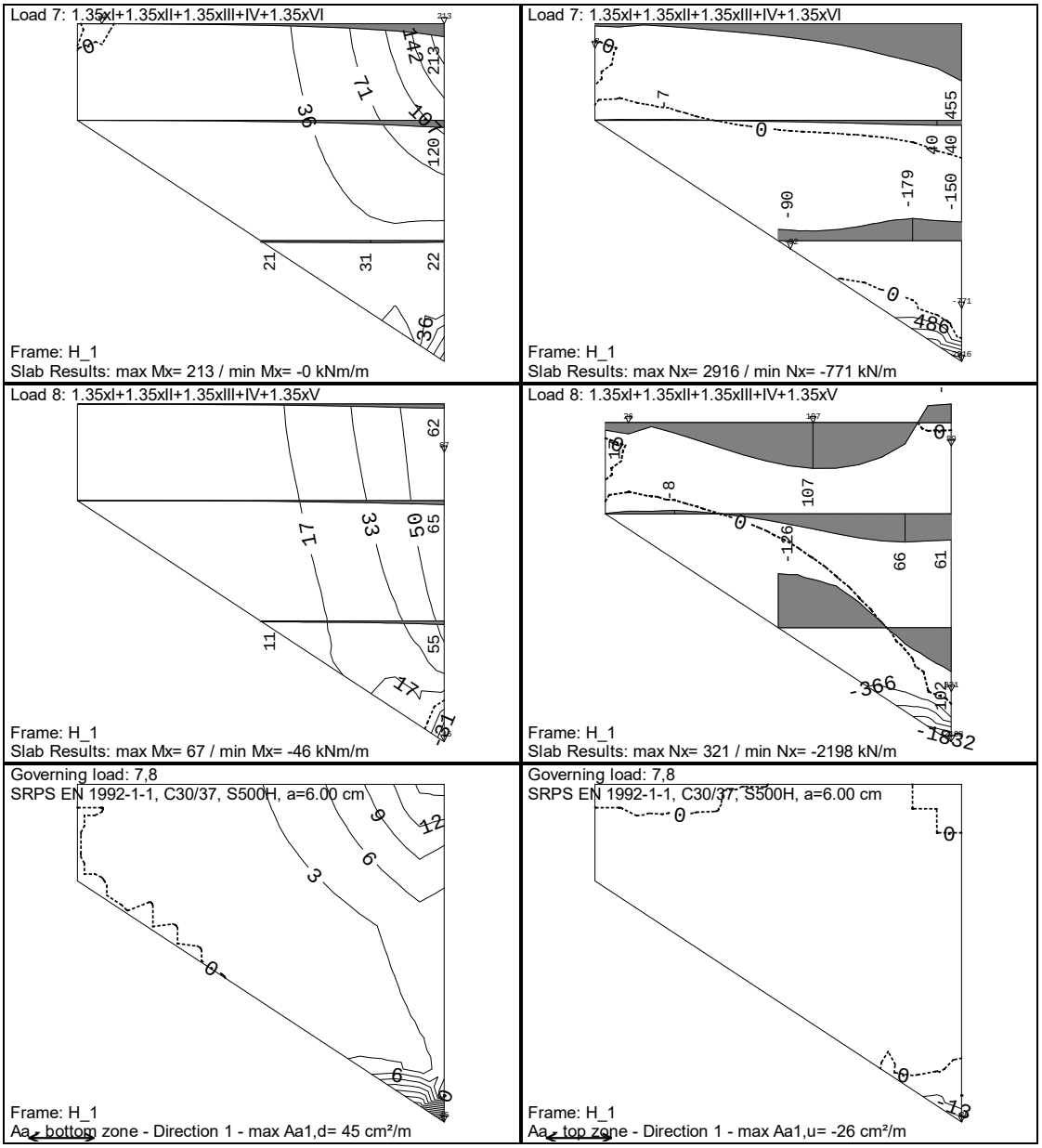
4.7.6 **Димензионисање /** Reinforcement design

Komb 1 → 1.35xI+1.35xII+1.35xIII+IV+1.35xVI

Komb 2 → 1.35xI+1.35xII+1.35xIII+IV+1.35xV

4.7.6.1 **Крило/** Wing wall l

d = 40 cm



Усвојена арматура / Provided reinforcement

Direction 1: (α=0°)

Φ14/15 (Aa = 10.26 cm2/m) → **спољна страна /** outer side

Φ20/15 (Aa = 20.93 cm2/m) → **унутрашња страна** / inner side

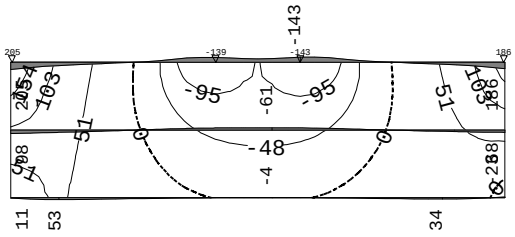
Direction 2: (α=90°) -

±Φ12/15 (Aa = 7.54 cm2/m)

4.7.6.2 **Zid /** Wall

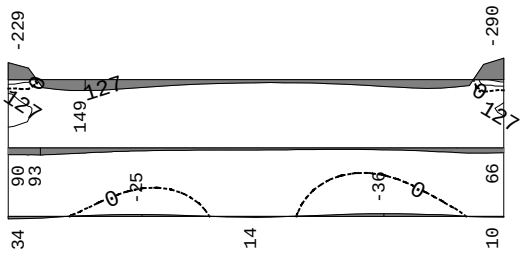
d = 30 cm

Load 7: 1.35xI+1.35xII+1.35xIII+IV+1.35xVI



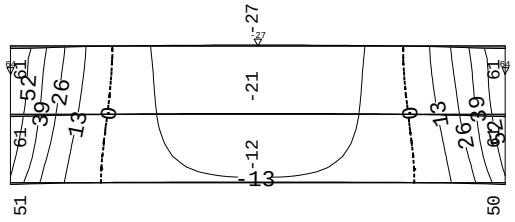
Frame: V_1
Slab Results: max Mx= 205 / min Mx= -143 kNm/m

Load 7: 1.35xI+1.35xII+1.35xIII+IV+1.35xVI



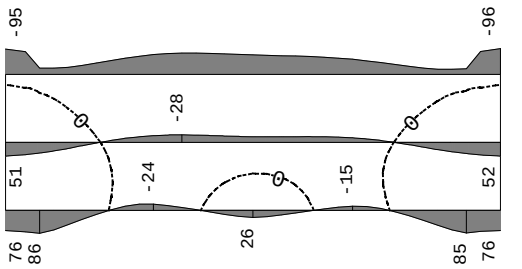
Frame: V_1
Slab Results: max Nx= 380 / min Nx= -449 kN/m

Load 8: 1.35xI+1.35xII+1.35xIII+IV+1.35xV



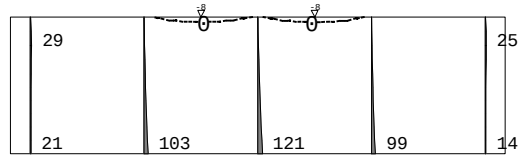
Frame: V_1
Slab Results: max Mx= 65 / min Mx= -27 kNm/m

Load 8: 1.35xI+1.35xII+1.35xIII+IV+1.35xV



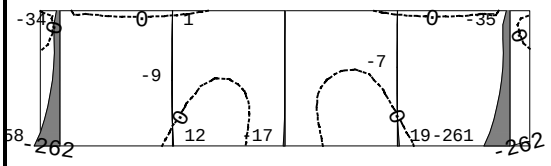
Frame: V_1
Slab Results: max Nx= 450 / min Nx= -1008 kN/m

Load 7: 1.35xI+1.35xII+1.35xIII+IV+1.35xVI



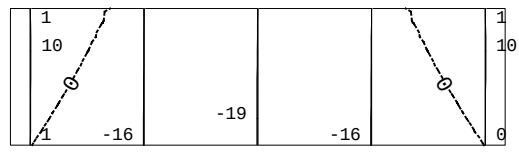
Frame: V_1
Slab Results: max My= 953 / min My= -8 kNm/m

Load 7: 1.35xI+1.35xII+1.35xIII+IV+1.35xVI



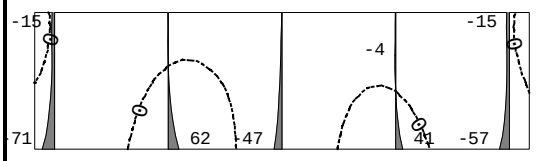
Frame: V_1
Slab Results: max Ny= 429 / min Ny= -1312 kN/m

Load 8: 1.35xI+1.35xII+1.35xIII+IV+1.35xV

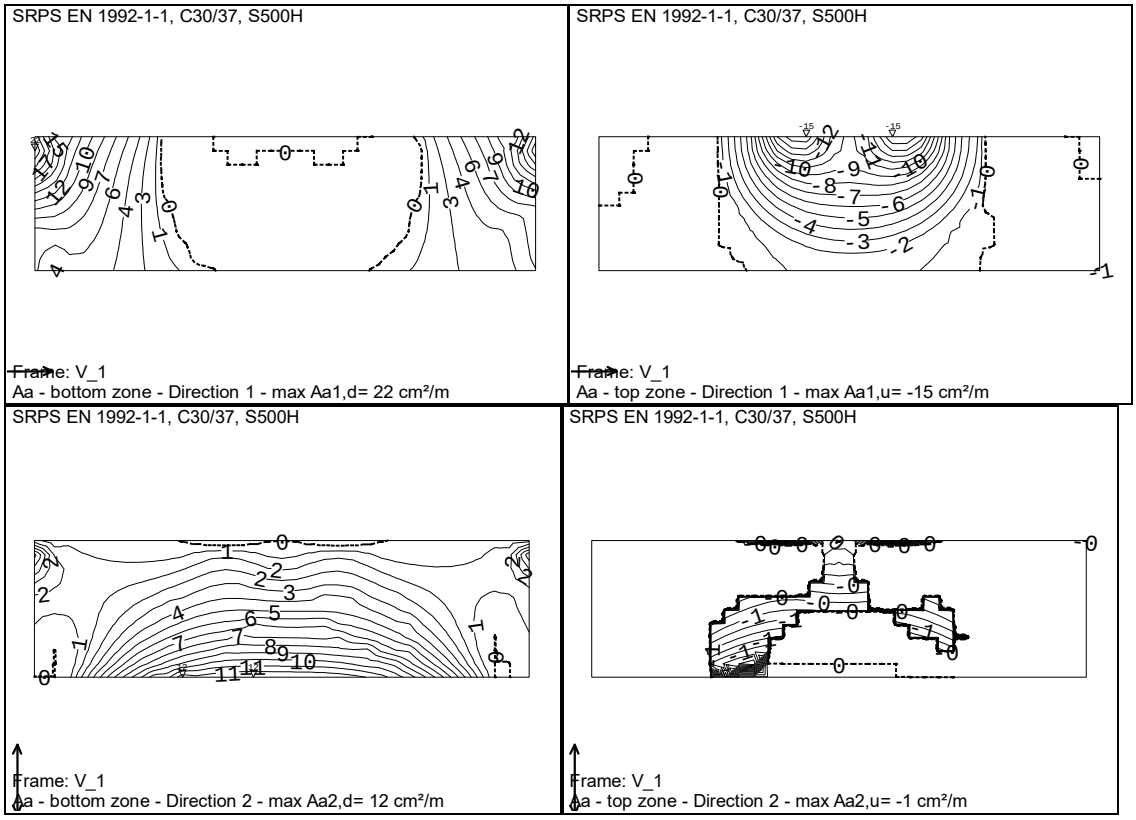


Frame: V_1
Slab Results: max My= 122 / min My= -80 kNm/m

Load 8: 1.35xI+1.35xII+1.35xIII+IV+1.35xV



Frame: V_1
Slab Results: max Ny= 1050 / min Ny= -2054 kN/m



Усвојена арматура / Provided reinforcement

Direction 1: (α=0°)

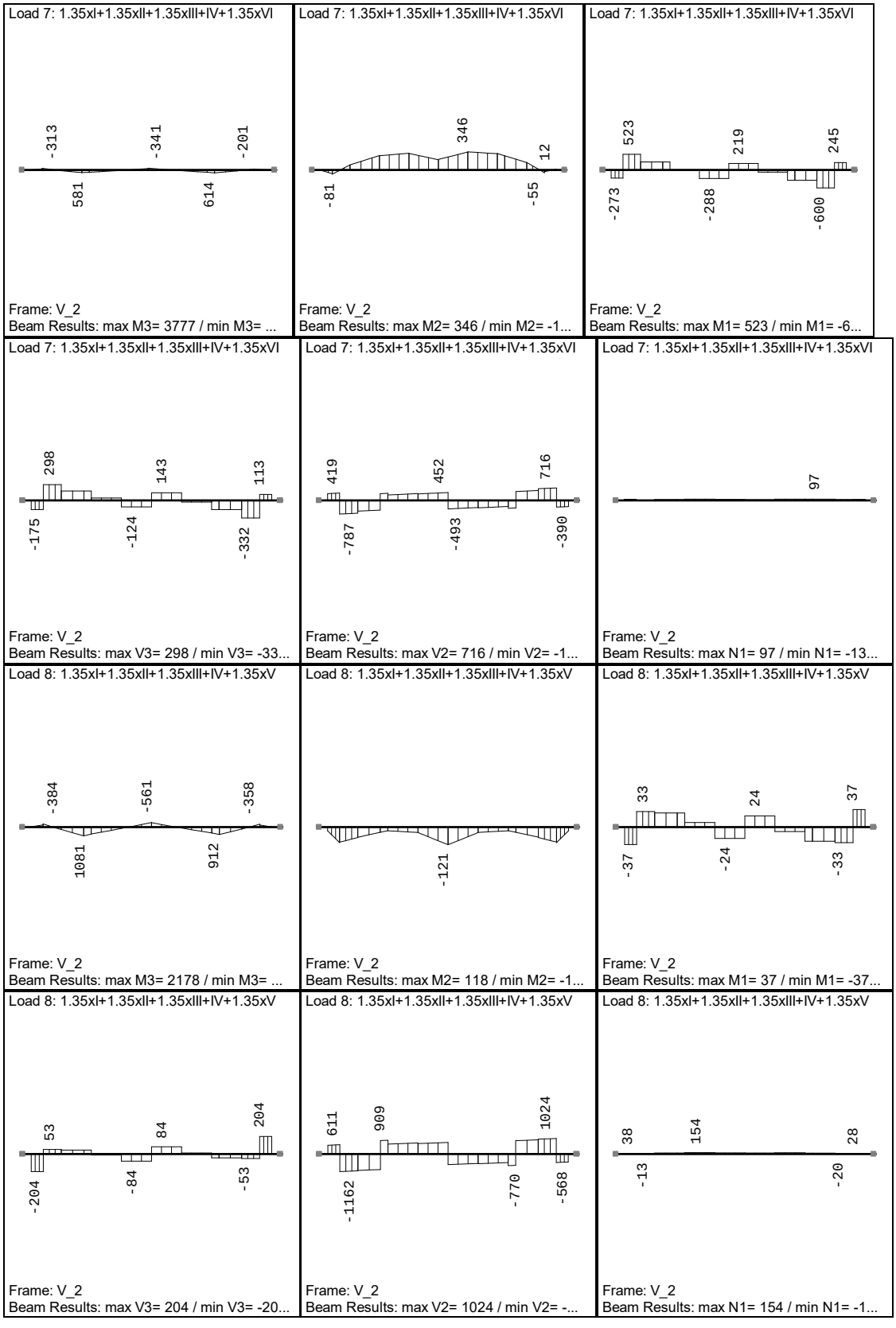
±Φ20/15 (Aa = 20.93 cm2/m)

Direction 2: (α=90°) -

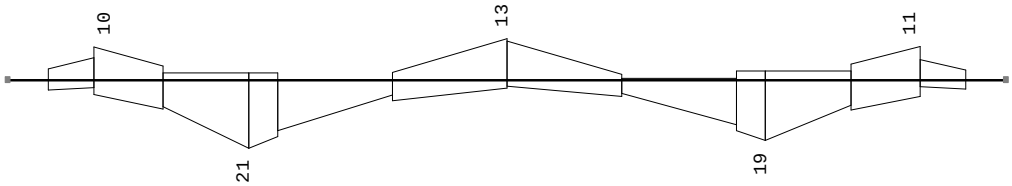
±Φ16/15 (Aa = 13.40 cm2/m)

4.7.6.3 **Лежишна греда /** Bearing beam s

d/b = 150/145 cm

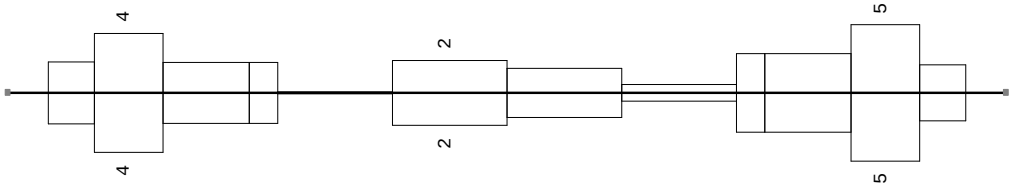


Governing load: 7,8
SRPS EN 1992-1-1, C30/37, S500H



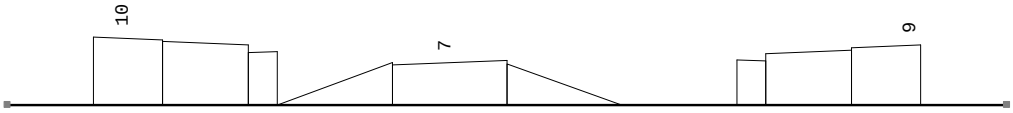
Frame: V_2
Beam reinforcement: max Aa2/Aa1= 13 / 21 cm²

Governing load: 7,8
SRPS EN 1992-1-1, C30/37, S500H



Frame: V_2
Beam reinforcement: max Aa3/Aa4= 5 / 5 cm²

Governing load: 7,8
SRPS EN 1992-1-1, C30/37, S500H



Frame: V_2
Beam reinforcement: max Aa,br= 10 cm²

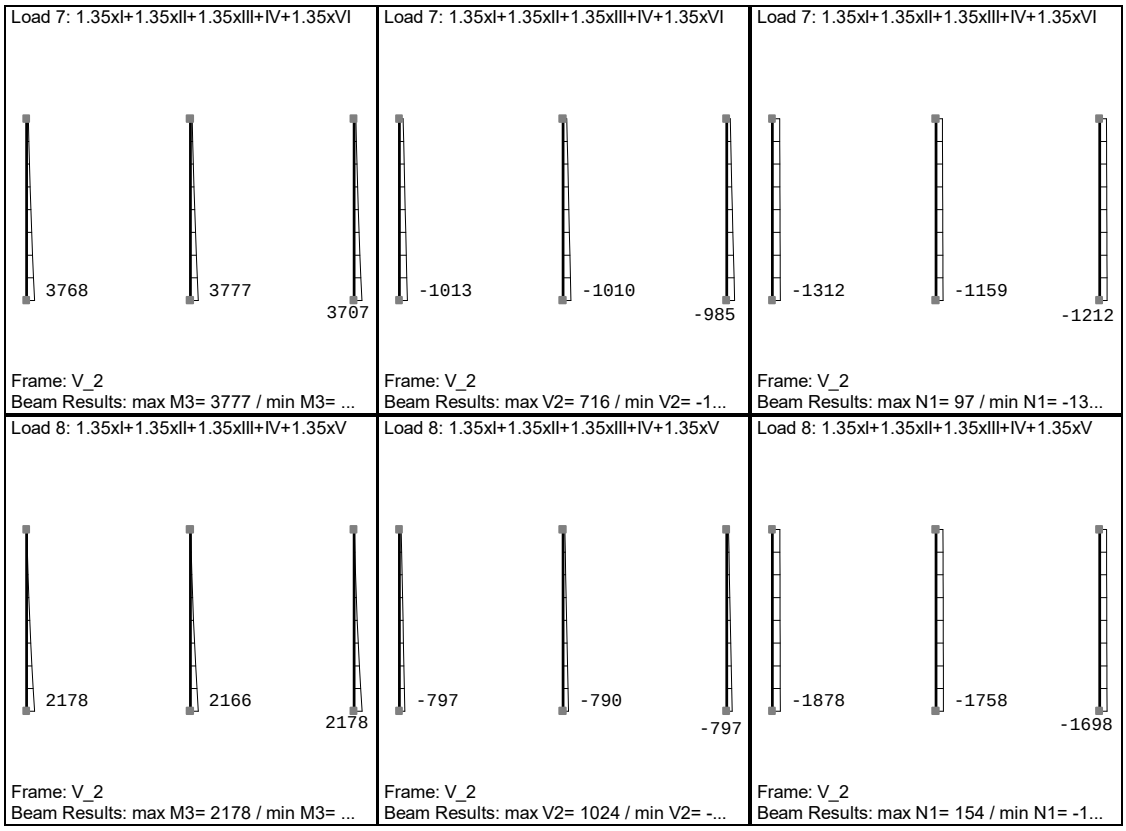
Усвојена арматура / Provided reinforcement

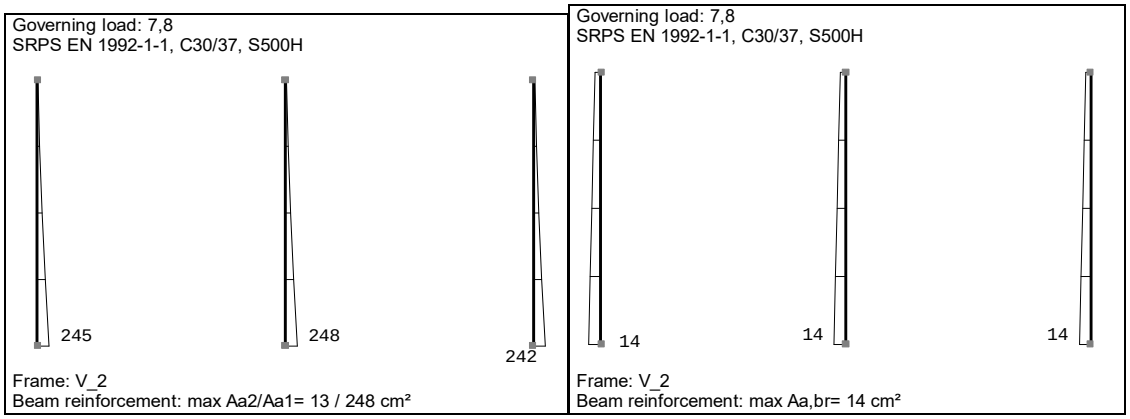
±14Φ20/15 (Aa = 43.96 cm2) **Подужна арматура** / Longitudinal reinforcement

Φ16/15 (Aa = 13.40 cm2/m) → **узенгије** / stirrups

4.7.6.4 Стуб / Column

Φ100 cm



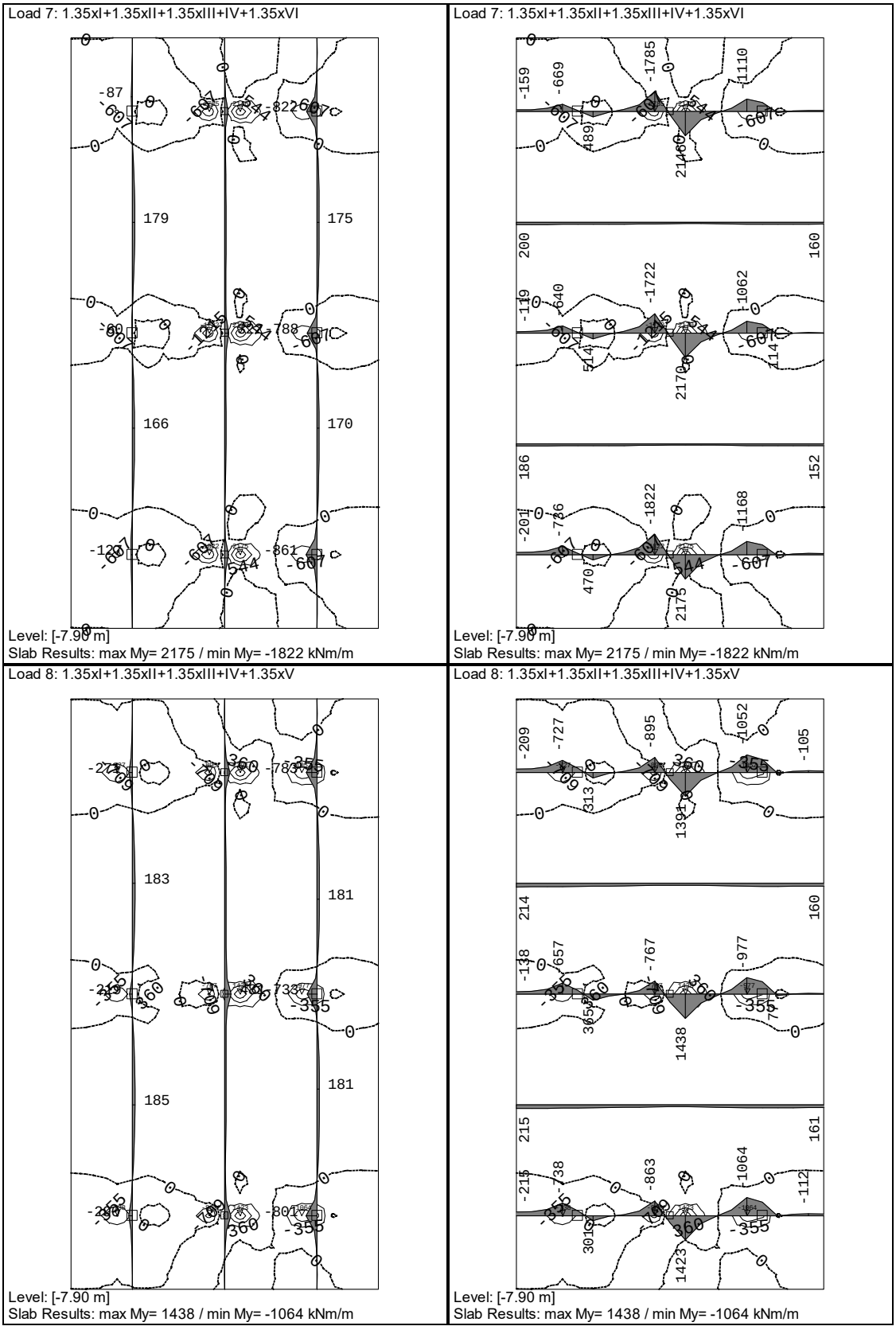


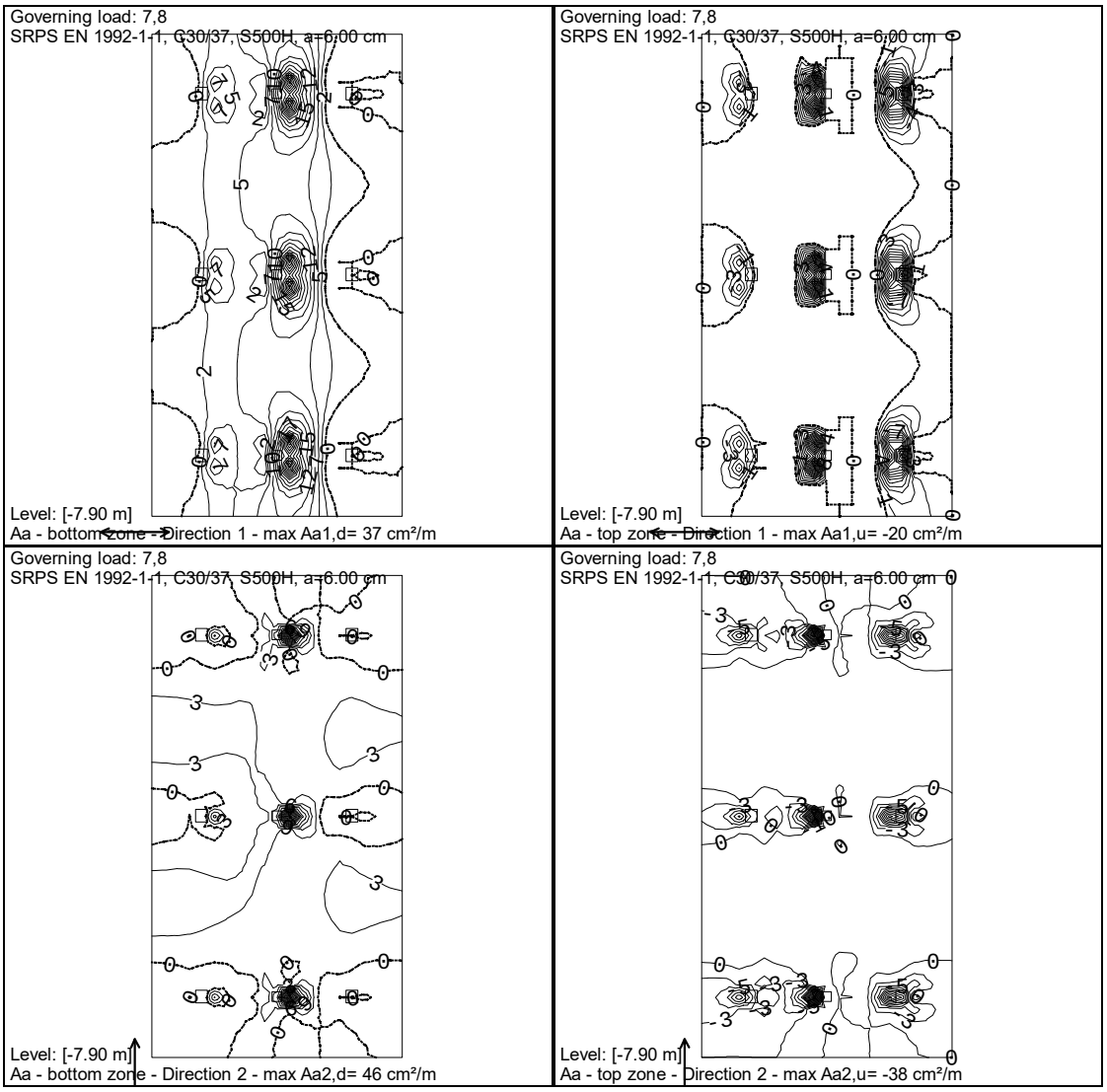
Усвојена арматура / Provided reinforcement

40Φ28/7.5 (Aa = 246.00 cm2) **Вертикална арматура**/ Vertical reinforcement

Φ14/10 (Aa = 15.39 cm2/m) → **узенгије** / stirrups

4.7.6.5 **Темељ /** Foundation





Усвојена арматура / Provided reinforcement

Direction 1: (α=0°)

Доња зона / Bottom zone

Φ25/10 (Aa = 49.07 cm2/m) → 1.5 m **трака изнад шипова /** lane above piles

Φ25/20 (Aa = 24.54 cm2/m) → 2.0 m **трака између шипова /** lane between piles

Горња зона / Top zone

Φ25/20 (Aa = 24.54 cm2/m)

Direction 2: (α=90°) -

Доња зона / Bottom zone

Φ25/10 (Aa = 49.07 cm2/m) → 1.5 m **трака изнад шипова /** lane above piles

Φ25/20 (Aa = 24.54 cm2/m) → 2.0 m **трака између шипова /** lane between piles

Горња зона / Top zone

Φ25/10 (Aa = 49.07 cm2/m) → 1.5 m **трака изнад шипова /** lane above piles

Φ25/20 (Aa = 24.54 cm2/m) → 1.5 m **трака између шипова /** lane between piles

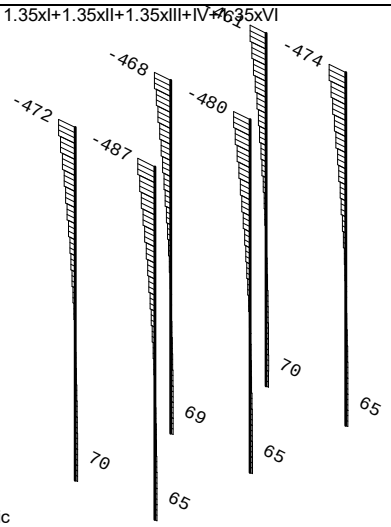
4.7.6.6 Шипови / Piles

5

Load 7: 1.35xI+1.35xII+1.35xIII+IV+1.35xVI

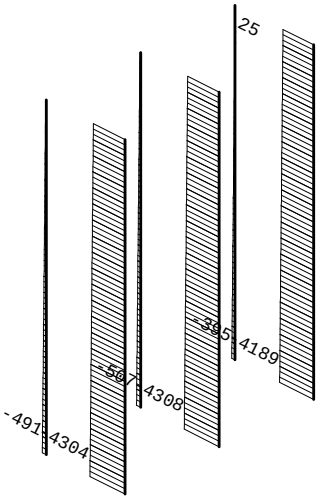
Isometric
Beam Results: max M3= 3777 / min M3= -1267 kNm

Load 7: 1.35xI+1.35xII+1.35xIII+IV+1.35xVI



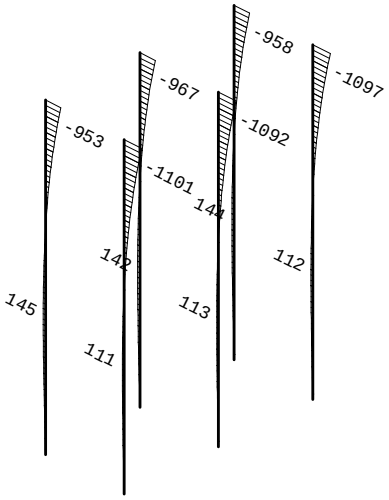
Isometric
Beam Results: max V2= 716 / min V2= -1013 kN

Load 7: 1.35xI+1.35xII+1.35xIII+IV+1.35xVI



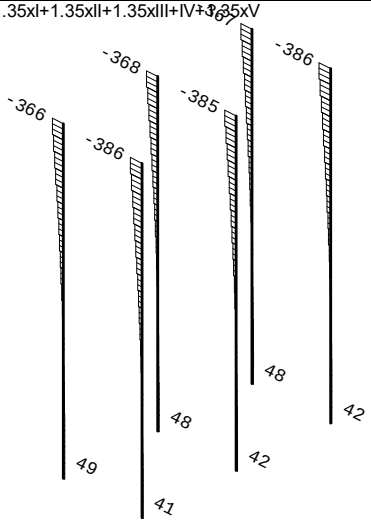
Isometric
Beam Results: max N1= 97 / min N1= -4308 kN

Load 8: 1.35xI+1.35xII+1.35xIII+IV+1.35xV



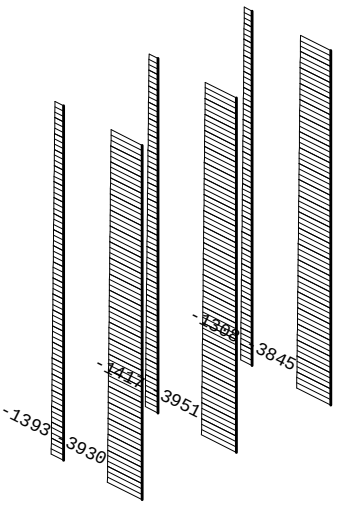
Isometric
Beam Results: max M3= 2178 / min M3= -1101 kNm

Load 8: 1.35xI+1.35xII+1.35xIII+IV+1.35xV

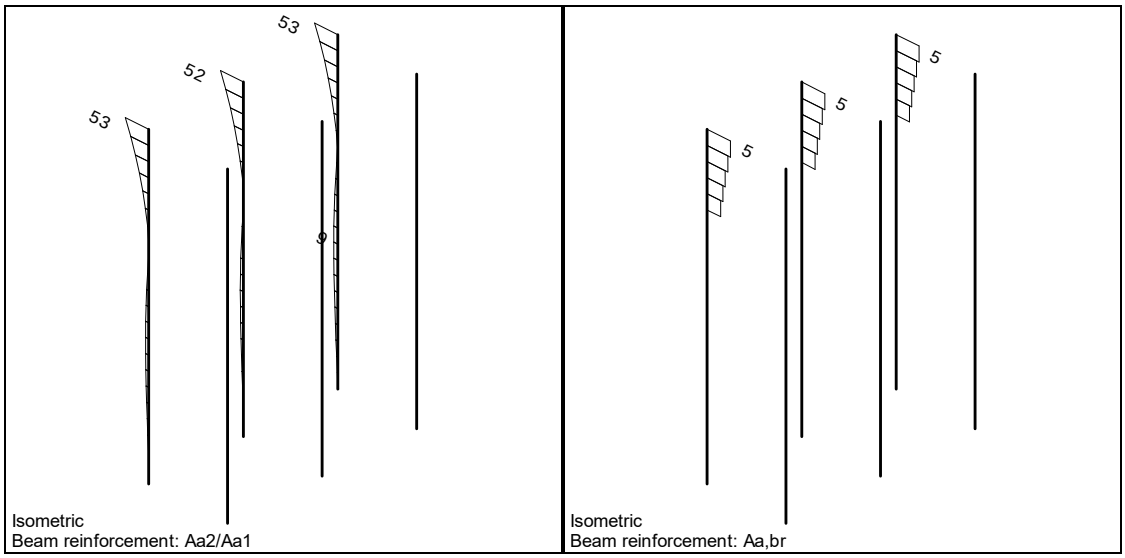


Isometric
Beam Results: max V2= 1024 / min V2= -1162 kN

Load 8: 1.35xI+1.35xII+1.35xIII+IV+1.35xV



Isometric
Beam Results: max N1= 154 / min N1= -3951 kN



Минимална арматура / Minimum reinforcement

Ф120 cm → Ab = 11304 cm2

Aa,min = 0.0025xAb = 0.0025x11304 = 28.26 cm2

Усвојена арматура / Provided reinforcement

18Ф20/20 (Aa = 56.52 cm2) **Вертикална арматура** / Vertical reinforcement

Ф12/15 (Aa = 7.54 cm2/m) → **узенгије** / stirrups

Максимална сила у шипу / Maximal axial force

Nmax = 3550 kN ULS

Nmax = 3177 kN SLS

Београд, април 2021.

Зоран Луковић, дипл. грађ. инж.

лиценца бр.: 310 3032 03

2/1-1.12.6.2 ПРЕДМЕР И ПРЕДРАЧУН

ПРОЈЕКАТ ЗА ГРАЂЕВИНСКУ ДОЗВОЛУ
ПРУГА: СУБОТИЦА - ДРЖАВНА ГРАНИЦА (Келебија)
КЊИГА 2/1-1.12: ПРОЈЕКАТ МОСТОВА
НАДВОЖЊАК на km 95+739.56

DESIGN FOR BUILDING PERMIT
RAILWAY LINE: BELGRADE - SUBOTICA - STATE BORDER (Kelebia)
BOOK 2/1-1.12: BRIDGE DESIGN
OVERPASS at km 95+739.56

Бр. поз. No.	Бр.поз. Техн Усл Item in Tech. Conditions	Опис радова	Description	Јед. мере Unit	Количина Quantity	Јед. цена (дин) Unit rate (Din)	Цена (дин) Price (Din)
					A	B	A´B
2/1.1.12.1	**02**	**ИЗВОЂЕЊЕ HW ШИПОВА**	**HW PILES**				
2/1.1.12.1.1		Извођење HW бушених шипова од бетона C 30/37, XC2,PVII У цену радова је укључен сав рад на извођењу, а плаћа се готов шип по m'. Арматура се плаћа посебно. Ø120 cm	Construct HW bored pipes of concrete C 30/37, XC2, PVII. The price covers all construction work and payment shall be made per each finished pipe, per linear meter. Reinforcement to be paid separately. Ø120cm	m'	468.00	50,000.00	23,400,000.00
2/1.1.12.1.2		Израда, уградња и монтажа арматуре HW шипова. Плаћа се по kg уграђене арматуре. B 500B	Prepare, position and tie rebars in HW piles. Payment per kg of placed rebars. B 500B	kg	56,160.00	120.00	6,739,200.00
2/1.1.12.1.3		Пробно оптерећење шипова, испитивање носивости шипова.	Carry out trial loading of piles to test pile capacity Lump sum payment.	паушално / lump sum			904,176.00
		УКУПНО ИЗВОЂЕЊЕ HW ШИПОВА:	**TOTAL FOR HW PILES:**				**31,043,376.00**
2/1.1.12.2	**03**	**ЗЕМЉАНИ РАДОВИ**	**EARTHWORKS**				
2/1.1.12.2.1		Ископ темеља у материјалу I и II категорије, са свом потебном подградом и транспортом ископаног материјала до 5 km. Плаћа се по m^3 ископаног материјала - на дубини 0-2 m - на дубини 2-4 m	Excavate foundations in soil cat. I & II, place necessary timbering and haul excavated earth to 5 km distance. Payment per m^3 of excavated material - 0-2 m by depth - 2-4 m by depth	 m^3 m^3	 992.88 0.00	 890.00 1,200.00	 883,663.20 0.00
2/1.1.12.2.2		Насипање материјала / затрпавање темеља стубова, из ископа или позајмишта, у слојевима по 30 cm, земљаним материјалом, са набијањем слојева до модула стшљивости Плаћа се по m^3 набијеног материјала	Backfill pier foundations using earth from borrow pit, in 30 cm layers tamped to modulus of compresibility of Ms=30MPa. Payment per m^3 of tamped earth	m^3	698.83	1,800.00	1,257,897.60
2/1.1.12.2.3		Израда шљунчаног клина иза крајњих стубова, до нивоа доње ивице прелазне плоче, од добро гранулисаног шљунка збијеног у слојевима од 30cm до модула стишљивости Ms=40 MPa.	Build gravel wedges behind end piers up to the transition slab underside of well grained gravel tamped in 30 cm layers to modulus of compressibility of Ms=40MPa.	m^3	545.74	2,000.00	1,091,475.00
2/1.1.12.2.4		Израда кегли, према пројекту, материјалом добијеним из усека или позајмишта са механичким набијањем у слојевима од по 30cm.	Build newly designed backwalls of earth recovered from cuttings or borrow pits and tamp them mechanically, 30 cm layers.	m^3	898.00	2,900.00	2,604,200.00
		УКУПНО ЗЕМЉАНИ РАДОВИ:	**TOTAL EARTH WORKS:**				**5,837,235.80**

ПРОЈЕКАТ ЗА ГРАЂЕВИНСКУ ДОЗВОЛУ
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КЊИГА 2/1-1.12: ПРОЈЕКАТ МОСТОВА
НАДВОЖЊАК на km 95+739.56

DESIGN FOR BUILDING PERMIT
RAILWAY LINE: BELGRADE - SUBOTICA - STATE BORDER (Kelebia)
BOOK 2/1-1.12: BRIDGE DESIGN
OVERPASS at km 95+739.56

Бр. поз. No.	Бр.поз. Техн Усл Item in Tech. Conditions	Опис радова	Description	Јед. мере Unit	Количина Quantity	Јед. цена (дин) Unit rate (Din)	Цена (дин) Price (Din)
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2/1.1.12.3	**04**	**БЕТОНСКИ И АРМИРАНОБЕТОНСКИ РАДОВИ**	**PLAIN AND REINFORCED CONCRETE**				
		Све позиције обухватају поред описа појединачних ставки и следеће заједничке услове : - Бетонски радови ће бити изведени у свему по пројекту, статичком прорачуну и важећим правилницима. Цене садрже све радне операције, утрошке материјала, помоћни алат, оплате и скеле које прописују "Нормативи и стандарди рада у грађевинарству-Високоградња ГН 400", као и остале трошкове и зараду предузећа. - Бетон ће бити справљен, транспортован, уграђен, негован и испитиван на пробним узорцима по одредбама SRPS EN 206 за бетон. - Бетон ће бити справљен од агрегата и цемента атестираних по важећим српским стандардима. - Бетон класе B.II мора имати све класе отпорности дефинисане појединачним позицијама. - Обрачун количина стварно изведених радова извршиће се према одредбама које прописују "Нормативи и стандарди рада у грађевинарству". -Мешање бетона мора се вршити машинским путем, а набијање вибрирањем -Арматура се плаћа посебно -Каблови се плаћају посебно -У цену бетона је урачуната оплата и скела -Плаћа се за потпуно готов посао од m³ уграђеног бетона				
	04.01	**Неармирани бетон**	**Plain concrete**				
2/1.1.12.3.1		Мршави бетон - изравњавајући слој, дебљине 10 cm, C12/15, испод темеља стубова, крилних зидова, темељних плоча, наглавних греда, прелазних плоча од бетона.	Cast lean concrete C12/15 for 10 cm thick blinding layers under pier foundations, wing walls, foundation slabs, pile caps, transition slabs.	m^3	29.88	12,000.00	358,560.00
	04.02	**Армирано бетонске темељне конструкције**	**Reinforced concrete foundations**				
2/1.1.12.3.2		Армирани бетон темеља стубова и темеља крилних зидова, тракастих темеља, контра-греда, плочастих темеља, јастука, наглавних греда и бунара. Бетон класе : C 30/37, XC2,PVII	Cast reinforced concrete in pier and wingwall foundations, strip foundations, counter beams, foundation mats, cushions, pile caps and wells. Concrete class: C 30/37, XC2,PVII	m^3	294.05	21,600.00	6,351,436.80
	04.03	**Стубови као ослонци распонских конструкција разних система и лежишне греде**	**Supporting piers under spanning construction of various systems and bearing beams**				
2/1.1.12.3.3		Тело крајњих стубова од бетона класе C 30/37, XC4, XD1, XF2, PV-I	Cast bodies of end piers concrete class C 30/37, XC4, XD1, XF2, PV-I	m^3	18.84	27,600.00	519,984.00
2/1.1.12.3.4		Крила и крилни зидови крајњих стубова од бетона класе C 30/37, XC4, XD1, XF2, PV-I	Cast wings and wing walls on end piers of concrete class C 30/37, XC4, XD1, XF2, PV-I	m^3	14.29	27,600.00	394,348.80

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КЊИГА 2/1-1.12: ПРОЈЕКАТ МОСТОВА
НАДВОЖЊАК на km 95+739.56

DESIGN FOR BUILDING PERMIT
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BOOK 2/1-1.12: BRIDGE DESIGN
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2/1.1.12.3.5		Лежишне греде крајњих стубова од бетона класе С 30/37, XC4, XD1, XF2, PV-I	Cast bearing beams on end piers of concrete class C 30/37, XC4, XD1, XF2, PV-I	m^3	40.46	27,600.00	1,116,558.00
2/1.1.12.3.6		Парапети, маске крајњих стубова од бетона класе С 30/37, XC4, XD1, XF2, PV-I	Cast parapet walls and masks on end piers of concrete class C 30/37, XC4, XD1, XF2, PV-I	m^3	14.10	27,600.00	389,160.00
2/1.1.12.3.7		Пешачке конзоле на крилима крајњих стубова од бетона класе С 30/37, XC4, XD1, XF2, PV-I	Cast footway cantilevers on end pier wings of concrete class C 30/37, XC4, XD1, XF2, PV-I	m^3	4.56	30,600.00	139,536.00
2/1.1.12.3.8		Тело средњих стубова од бетона класе С 30/37, XC4, XD1, XF2, PV-I	Cast bodies of middle piers of concrete class C 30/37, XC4, XD1, XF2, PV-I	m^3	126.48	27,600.00	3,490,848.00
2/1.1.12.3.9		Лежишне греде и маске средњих стубова од бетона класе С 30/37, XC4, XD1, XF2, PV-I	Cast bearing beams and masks on middle piers of concrete class C 30/37, XC4, XD1, XF2, PV-I	m^3	54.22	30,600.00	1,659,009.60
2/1.1.12.3.10		Квадери крајњих и средњих стубова од бетона класе С 40/50, XC4, XF1,PVI	Cast squared stones on end and middle piers of concrete class C 40/50, XC4, XD1, XF2, PV-I	m^3	0.51	30,600.00	15,667.20
	04.04	**Распонска конструкција моста од армираног бетона**	**Bridge constructions in spans of reinforced concrete**				
2/1.1.12.3.11		Коловозна плоча од армираног бетона преко монтажних носача. У цену урачуната привремена оплата између монтажних носача. Бетон класе С 35/45, XC4, XD1, XF2, PV-II	Cast bridge deck of reiforced concrete on top of precast girders. Price includes temporary formwork between precast girders. Concrete class C 35/45, XC4, XD1, XF2, PV-II.	m^3	305.63	30,600.00	9,352,216.80
2/1.1.12.3.12		Армиранобетонски попречни носачи за везу главних носача. Бетон класе С 35/45, XC4, XD1, XF2, PV-II	Cast reinforced concrete cross girders connecting main girders. Concrete class C 35/45, XC4, XD1, XF2, PV-II	m^3	67.88	27,000.00	1,832,760.00
2/1.1.12.3.13		Ивични венци пешачких стаза ливени на лицу места, (укључујући и ревизионе шахтове) од бетона класе С 40/50, XC4, XD3, XF4, PV-II	Cast in situ footway cornices (with inspection chambers) of concrete class C 40/50, XC4, XD3, XF4, PV-II	m^3	152.35	37,200.00	5,667,494.40
2/1.1.12.3.14		Прелазне плоче, од бетона С 30/37, XC4	Cast transition slabs of concrete C 30/37, XC4	m^3	24.00	25,200.00	604,800.00
	04.05	**Распонска конструкција моста од преднапрегнутог бетона**	**Bridge construction in span of prestressed concrete**				
2/1.1.12.3.15		Префабриковани главни носачи од преднапрегнутог бетона Бетон:С 45/55,XC4, XD1, XF2, PV-II цемент класе "N"	Prefabricated main girders made from pre-stressed concrete Concrete: C 45/55,XC4, XD1, XF2, PV-II cement class "N"	m^3	486.30	42,000.00	20,424,600.00

УКУПНО БЕТОНСКИ РАДОВИ:	**TOTAL FOR CONCRETING:**	**52,316,979.60**

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КЊИГА 2/1-1.12: ПРОЈЕКАТ МОСТОВА
НАДВОЖЊАК на km 95+739.56

DESIGN FOR BUILDING PERMIT
RAILWAY LINE: BELGRADE - SUBOTICA - STATE BORDER (Kelebia)
BOOK 2/1-1.12: BRIDGE DESIGN
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2/1.1.12.4	**05**	**РАДОВИ ОД МЕТАЛА**	**METALWORK**				
		Све позиције обухватају поред описа појединачних ставки и следеће заједничке услове: - Армирачки радови ће бити изведени у свему по пројекту, статичком прорачуну и важећим правилницима. Цене садрже све радне операције, утрошке материјала, помоћни алат и скеле које прописују "Нормативи и стандарди рада у грађевинарству-Високоградња ГН 400", као и остале трошкове и зараду предузећа. - Арматуру очистити од рђе и прљавштине, исправити, исећи, савити и уградити по детаљима (арамтурним нацртима) и статичком прорачуну. - За квалитет уграђене арматуре одговара извођач радова. - Јединична цена садржи и постављање подметача од челика,пластике или бетона за постизање предвиђених заштитних слојева и правилног положаја арматуре у конструкцији. Сва подеона гвожђа и узенгије ће бити чврсто везани за главну арматуру тако да не може доћи до промене положаја арматуре за време бетонирања конструкције. - Стварно уграђена количина арматуре свих квалитета обрачунава се по kg без обзира на сложеност и пречнике шипки арматуре. - Обрачун количина извршити према табличним тежинама арматуре и ужади и дужинама из арматурних нацрта.				
2/1.1.12.4.1		Набавка, чишћење, сечење, машинско савијање и монтажа арматуре према пропису, пројекту и статичким детаљима. Плаћа се по kg уграђене арматуре. Ребраста арматура B 500B	Purchase, wire brush, cut, bend mechanically and position bars according to the regulation, the design and the static detailed drawings. Payment per kg of positioned bars. Ribbed reinforcement B 500B	kg	240,548.85	120.00	28,865,862.00
2/1.1.12.4.2		Високовредна, патентирана ужад за преднапрезање са свим котвама, подложним плочицама, пресама и заштитним цевима за каблове. Класа Y1860S7-16.0-A. Плаћа се по kg уграђеног челика за преднапрезање.	Patented high-strength prestressing strands with all anchors, bearing plates, jacks and protective cable pipes . Class Y1860S7-16.0-A. Payment per kg of positioned bars.	kg	30,259.92	400.00	12,103,968.00
		УКУПНО АРМИРАЧКИ РАДОВИ:	**TOTAL METALWORK:**				**40,969,830.00**

ПРОЈЕКАТ ЗА ГРАЂЕВИНСКУ ДОЗВОЛУ
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DESIGN FOR BUILDING PERMIT
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2/1.1.12.5	**06**	**ИЗОЛАТЕРСКИ РАДОВИ**	**WATERPROOFING**				
		- Сви изолатерски радови морају бити изведени педантно и тачно према захтевима из пројекта, предрачуна радова и детаљима. - Употребљени материјали морају одговарати важећим стандардима и прописима, снабдевени атестима овлашћене установе, проверени у употреби, трајни колико и објекат или пројектовани тако да је њихова замена могућа. - Све грешке на конструкцији морају се на одговарајући начин отклонити или санирати пре почетка наношења изолационог материјала. - У јединичну цену је урачуната набавка свог потребног материјала, алата, транспорт и израда. - Плаћа се за потпуно готов посао по m^2 урађене изолације и/или заштите.					
2/1.1.12.5.1		Израда хидроизолације горње плоче и конзола на бази метил метакрилата, прскањем под притиском. Радови по овој позицији се изводе у складу са техничким условима и нормативима за ову врсту послова као и по технологији произвођача. У цену су у рачунати набавка материјала, транспорт и уградња.	Spray under pressurea layer of waterproofing material based on methyl metacrilate on deck and cantilevers.Work against this item shall conform to the relevant technical conditions and standards, and the manufacturer's technology. The price includes purchase of materials, transport and application.	m^2	1,307.61	4,150.00	5,426,581.50
2/1.1.12.5.2		Израда хидроизолације од једног хладног премаза битулитом и једног премаза врућим битуменом бетонских површина које су у контакту са земљом.	Apply waterproofing of one cold coat of bitumen emulsion and one hot bitumen coat onto concrete surfaces in contact with ground.	m^2	1,027.82	1,200.00	1,233,384.00
2/1.1.12.5.3		Израда заштите бетонских површина заштитним хидрофобним премазом за бетон, на бази пенетрата. Површине морају бити претходно очишћене и суве. Премазивање подразумева заштиту и импрегнацију свих видљивих бетонских површина моста које су у додиру са атмосферским утицајима.	Protect concrete surfaces with protective hydrophobic penetrat-based coats. Surfaces shall be clean and dry prior to application. This means that all visible concrete surfaces on the bridge exposed to atmosphere shall be coated for the purpose of protection and impregnation.	m^2	5,071.00	2,000.00	10,142,000.00
2/1.1.12.5.4		Заштитни премаз бетона на пешачким стазама, степеницама и подестима, d=3-3.5 mm, формираног од 4 слоја:епокси прајмер, водоотпорни слој пур смоле, основни премаз пур смоле(полиуретан) са кварц песком (0.5-1 mm) и завршни слој пур смоле.	Apply protective coats onto concrete surface on footways, steps and landings, 3-3.5 mm thick, 4-ply of epoxy primer, water repellent pur resin, base coat of pur resin (polyurethane) with quartz sand (0.5-1 mm) and top coat of pur resin.	m^2	492.23	2,500.00	1,230,575.00
		УКУПНО ИЗОЛАТЕРСКИ РАДОВИ:	**TOTAL WATERPROOFING:**				**18,032,540.50**

ПРОЈЕКАТ ЗА ГРАЂЕВИНСКУ ДОЗВОЛУ
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RAILWAY LINE: BELGRADE - SUBOTICA - STATE BORDER (Kelebia)
BOOK 2/1-1.12: BRIDGE DESIGN
OVERPASS at km 95+739.56

Бр. поз. No.	Бр.поз. Техн Усл Item in Tech. Conditions	Опис радова	Description	Јед. мере Unit	Количина Quantity	Јед. цена (дин) Unit rate (Din)	Цена (дин) Price (Din)
					A	B	A´B
2/1.1.12.6	**07**	**ЛЕЖИШТА И ДИЛАТАЦИЈЕ**	**BEARINGS AND EXPANSION JOINTS**				
2/1.1.12.6.1		Израда и постављање лончастих лежишта. Плаћа се по комаду постављеног лежишта. попречно непокретна Nd=2772 kN; Vx,d=542 kN, Ud=±90mm	Cast and position pot bearings. Payment per each bearing in place. fixed in transverse direction, Nd=2772 kN; Vx,d=542 kN, Ud=±90mm	ком	4.00	250,000.00	1,000,000.00
2/1.1.12.6.2		Армиране еластомерне дилатационе спојнице , набавка и уградња према пројекту Плаћа се по m' уграђене дилатационе спојнице. средња померања	Reinforced elastomer expansion joints, purchase and fixing as designed. Payment per each fixed expansion joint. for medium movement	m'	20.00	100,000.00	2,000,000.00
УКУПНО ЛЕЖИШТА И ДИЛАТАЦИЈЕ:			**TOTAL BEARINGS AND EXPANSION JOINTS:**				**3,000,000.00**
2/1.1.12.7	**08**	**ОСТАЛИ РАДОВИ**	**MISCELLANEOUS**				
		За све позиције наведених радова важи: * у цену је урачуната набавка свог потребног материјала, алата, механизације, транспорт, израда и монтажа према пројекту, а за комплетно завршен					
2/1.1.12.7.1		Сливници од ливеног гвожђа C-6, набавка и уградња према пројекту. Плаћа се по комаду уграђеног сливника.(део Пројекта	Purchase and fix cast iron gullies C-6 according to design. Payment per each gully in place (treated in Drainage design).	ком	6.00	50,000.00	300,000.00
2/1.1.12.7.2		Ливене цеви за одвод воде из сливника укључујући и сав причврсни прибор. Плаћа се по m' уграђене цеви. (део Пројекта одводњавања)	Place cast iron gully piping and all fittings. Payment per m' of gully piping (treated in Drainage design).	m'	130.00	2,700.00	351,000.00
2/1.1.12.7.3		Израда и постављање ограде од челика S 235 JRG1. У цену је урачуната набавка материјала, израда, транспорт, монтажа, антикорозиона заштита са два основна и два завршна премаза покривном бојом, а у свему према пројекту. Плаћа се по kg постављене ограде. -цевне или од профила - висока жичана заштитна ограда	Assemble and erect railing and fence of S 235 JRG1 steel. The price includes purchase of material, assembly transport, erection, anticorrosive protection of two primers and two top coats of paint, fully as designed. Payment per kg of railing/fence. - tubular railing or sections - high protective fence of steel mesh	kg kg	16,280.00 1,824.00	250.00 250.00	4,070,000.00 456,000.00
2/1.1.12.7.4		Коловозни застор од асфалт бетона, дебљине	Spread surfacing of asphalt concrete, 7 cm thick.	m^2	901.80	1,600.00	1,442,880.00
2/1.1.12.7.5		Уграђивање ПВЦ цеви у пешачке (ревизионе) стазе Ф100mm. Плаћа се по m' уграђених цеви.	Insert PVC pipes in footways (inspection ways) Ф100mm. Payment per m' of inserted pipes.	m'	952.20	450.00	428,490.00

ПРОЈЕКАТ ЗА ГРАЂЕВИНСКУ ДОЗВОЛУ
ПРУГА: СУБОТИЦА - ДРЖАВНА ГРАНИЦА (Келебија)
КЊИГА 2/1-1.12: ПРОЈЕКАТ МОСТОВА
НАДВОЖЊАК на km 95+739.56

DESIGN FOR BUILDING PERMIT
RAILWAY LINE: BELGRADE - SUBOTICA - STATE BORDER (Kelebia)
BOOK 2/1-1.12: BRIDGE DESIGN
OVERPASS at km 95+739.56

Бр. поз. No.	Бр.поз. Техн Усл Item in Tech. Conditions	Опис радова	Description	Јед. мере Unit	Количина Quantity	Јед. цена (дин) Unit rate (Din)	Цена (дин) Price (Din)
					A	B	A´B
2/1.1.12.7.6		Израда и затварање спојница на контакту на асфалта и ивичњака и уз дилатационе справе трајно еластичном масом. Плаћа се по m' уграђене спојнице.	Prepare and close joints in concrete surface at the joints between asphalt and curb lines and at expansion joints with durably elastic mass. Payment per m' of finished joint.	m'	341.40	3,000.00	1,024,200.00
2/1.1.12.7.11		Израда и затварање спојница на бетону на степенишном делу, уз ивичњаке и венце на пешачким стазама, трајно еластичном масом. Плаћа се по m' уграђене спојнице.	Prepare and close joints in concrete surface on the stairs, between curb lines and footway cornices a with durably elastic mass. Payment per m' of finished joint.	m'	349.00	3,000.00	1,047,000.00
2/1.1.12.7.7		Ивичњаци бетонски или камени 20/25 cm.	Place curbs of concrete or stone 20/25 cm	m'	317.40	2,600.00	825,240.00
2/1.1.12.7.8		Испитивање готовог моста.	Test the newly built bridge.	паушално / lump sum			1,500,000.00
2/1.1.12.7.9		Фотографско снимање у току изградње моста.	Make photo records in the course bridge building	паушално / lump sum			150,000.00
2/1.1.12.7.10		Израда и уграђивање плоче са годином изградње моста.	Prepare and fix a plate inscribed with the year of bridge building.	паушално / lump sum			15,000.00
		УКУПНО ОСТАЛИ РАДОВИ:	**TOTAL MISCELLANEOUS:**				**11,609,810.00**

ЗБИРНА РЕКАПИТУЛАЦИЈА GRAND SUMMARY

2/1.1.12.1	**02**	**ИЗВОЂЕЊЕ HW ШИПОВА**	**HW PILES**	**31,043,376.00**
2/1.1.12.2	**03**	**ЗЕМЉАНИ РАДОВИ**	**EARTHWORKS**	**5,837,235.80**
2/1.1.12.3	**04**	**БЕТОНСКИ И АРМИРАНОБЕТОНСКИ РАДОВИ**	**PLAIN AND REINFORCED CONCRETE**	**52,316,979.60**
2/1.1.12.4	**05**	**РАДОВИ ОД МЕТАЛА**	**METALWORK**	**40,969,830.00**
2/1.1.12.5	**06**	**ИЗОЛАТЕРСКИ РАДОВИ**	**WATERPROOFING**	**18,032,540.50**
2/1.1.12.6	**07**	**ЛЕЖИШТА И ДИЛАТАЦИЈЕ**	**BEARINGS AND EXPANSION JOINTS**	**3,000,000.00**
2/1.1.12.7	**08**	**ОСТАЛИ РАДОВИ**	**MISCELLANEOUS**	**11,609,810.00**

УКУПНО (дин): **GRAND TOTAL (Din):** **162,809,771.90**

Београд, Април 2021.

Одговорни пројектант:

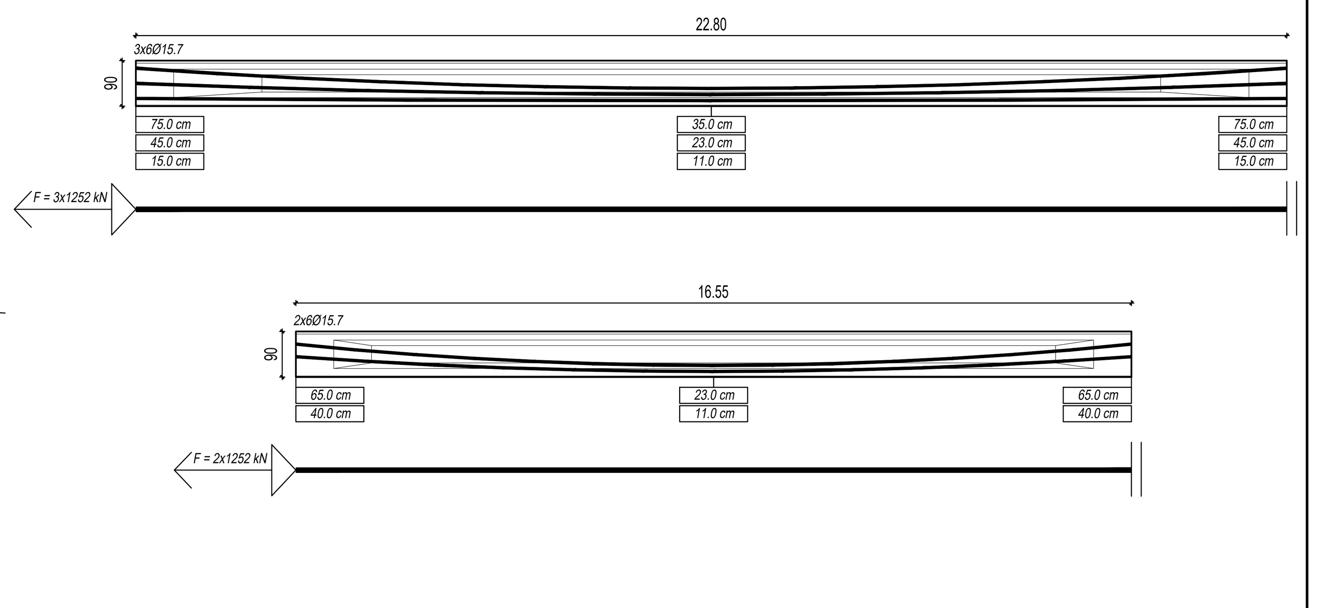
Зоран Луковић, дипл.грађ.инж
лиценца бр.: 310 3032 03

Belgrade, April 2021

Responsible designer:

Zoran Luković , grad.Civ.Eng.
Licence no.: 310 3032 03

2/1-1.12.7 ГРАФИЧКА ДОКУМЕНТАЦИЈА



КАБЛОВИ /CABLES	fpy/fpk=1670/1860 MPa (Ø15.7mm)

КАРАКТЕРИСТИКЕ МАТЕРИЈАЛА

Елемент	Бетон	Арматура	Заштитни слој
Претходно напрегнути носачи	C 45/55, XC4, , XF1, PV-II	B500B	4.0
Коловозна плоча и попр. носачи	C 35/45, XC3, , XF1, PV-II	B500B	4.0
Ивични венци и пешачке стазе	C 40/50, XC4, XD3, XF4, PV-II	B500B	4.5
Лежишне греде и квадери	C 30/37, XC3, , XF1, PV-I	B500B	4.0
АБ стубови	C 30/37, XC4, , XF1, PV-I	B500B	5.0
АБ потпорни зидови	C 30/37, XC4, , XF1, PV-I	B500B	5.0
Шипови	C 30/37, XC2, PV-I	B500B	мин 7.5cm
Наглавне греде	C 30/37, XC2, PV-I	B500B	5.0
Прелазна плоча	C 30/37, XC2, PV-I	B500B	5.0
Подбетон	C 12/15, X0		

MATERIAL PROPERTIES

Component	Бетон	Reinforcement	Clear cover
Prestressed girders	C 45/55, XC4, , XF1, PV-II	B500B	4.0
Deck slab and diaphragms	C 35/45, XC3, , XF1, PV-II	B500B	4.0
Edge beams and sidewalks	C 40/50, XC4, XD3, XF4, PV-II	B500B	4.5
Pier caps and bearing pedestals	C 30/37, XC3, , XF1, PV-I	B500B	4.0
Pier columns and abutments	C 30/37, XC4, , XF1, PV-I	B500B	5.0
Retaining walls	C 30/37, XC4, , XF1, PV-I	B500B	5.0
Piles	C 30/37, XC2, PV-I	B500B	min 7.5cm
Pile caps	C 30/37, XC2, PV-I	B500B	5.0
Approach slabs	C 30/37, XC2, PV-I	B500B	5.0
Lean concrete	C 12/15, X0		

Број/Number	Датум / Date	Опис / Description
03		
02		
01		

Ревизиони блок: / Revision block:

中国铁设 CRDC
China Railway Design Corporation Serbia
Ogranak Beograd
Косте Рацина 16б; 11000 Београд; Србија

Организациона јединица: ГРАЂЕВИНАРСТВО И САОБРАЋАЈ
Organization unit: DEPARTMENT OF CIVIL AND TRANSPORTATION

Одговорни пројектант: / Responsible designer:
Зоран Луковић, дипл.грађ.инж
лиценца број:/ license No.: 310 3032 03

Сарадници: / Associates:
Предраг Бакић, дипл.грађ.инж.
Душко Бобера, дипл.грађ.инж.
Ивана Тадић, дипл.грађ.инж.
Мирослав Раднић, дипл.грађ.инж.
Иван Мићовић, дипл.грађ.инж.

Унутрашња контрола: / Internal control:
Ruan Lidong. Bachelor & Tian Shanpo. Bachelor

Главни пројектант: / Chief designer:
др Љиљана Милић Марковић, дипл.грађ.инж.

Руководилац организационе јединице: / Manager of organization unit:
др Љиљана Милић Марковић, дипл.грађ.инж.

Инвеститор пројекта: / Investor:
" ИНФРАСТРУКТУРА ЖЕЛЕЗНИЦЕ СРБИЈЕ " А.Д.
/ " INFRASTRUCTURE RAILWAYS OF SERBIA " JSC
Немањина 6/IV, Београд / Nemanjina Street 6/IV, Belgrade

Наручилац пројекта: / Employer:
China Railway International Corporation Ltd.
No.10 Fuxing Road,Haidian District,Beijing
P.R China, 100844
China Communication Construction Company Ltd. (CCCC)
No.85 Deshengmenwai Street,Xicheng District,Beijing
P.R China, 100088

Објекат: /Structure:
ПРУГА БЕОГРАД - СУБОТИЦА - ДРЖАВНА ГРАНИЦА (КЕЛЕБИЈА)
ДЕОНИЦА ПРУГЕ НОВИ САД - СУБОТИЦА - ДРЖАВНА ГРАНИЦА (КЕЛЕБИЈА)
BELGRADE - SUBOTICA - STATE BORDER (KELEBIA) RAILWAY LINE
SECTION : NOVI SAD - SUBOTICA - STATE BORDER (KELEBIA)

Део пројекта: / Part of Design:
ПРОЈЕКАТ КОНСТРУКЦИЈА / DESIGN OF CONSTRUCTION

2/1.1.12 Пројекат надвожњака на км 95+739,56
2/1.1.12 Overpass at km 95+739,56

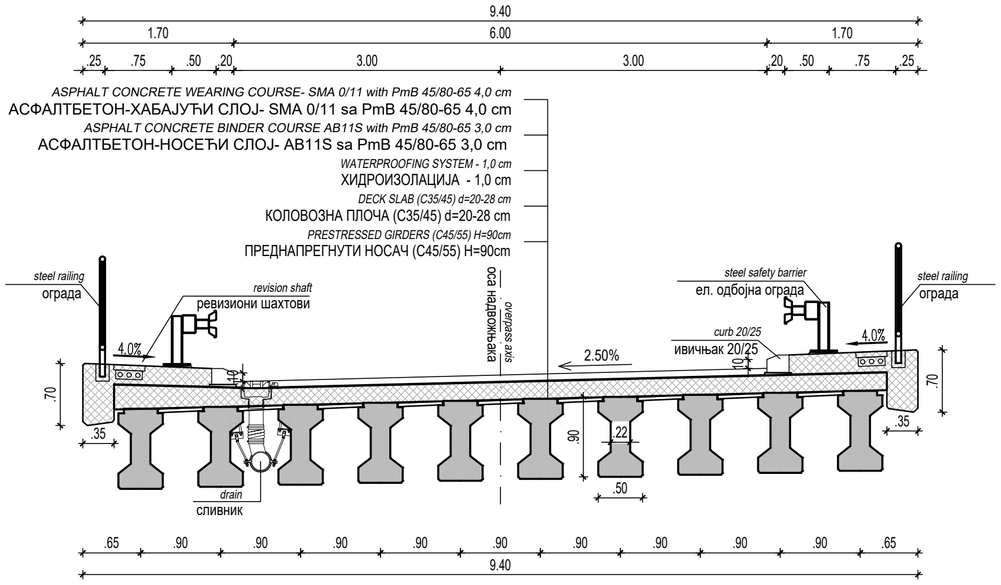
Цртеж:/ Drawing:	Размера: Scale:
ОСНОВА, ПОДУЖНИ ПРЕСЕК, ИЗГЛЕД / LAYOUT, LONGITUDINAL SECTION, VIEW	1:200

Врста тех. док.: Type of tech. docum.:	датум:/date:	Цртеж бр./Drawing No.:
ПГД / DCP	04.2021.	2020-001-ГС-2/1.1.12.7.Ц01.

КАРАКТЕРИСТИЧНИ ПОПРЕЧНИ ПРЕСЕК

TYPICAL CROSS SECTION

R/SC 1:50



КАРАКТЕРИСТИКЕ МАТЕРИЈАЛА

Елемент	Бетон	Арматура	Заштитни слој
Претходно напрегнути носачи	C 45/55, XC4, , XF1, PV-II	B500B	4.0
Коловозна плоча и попр. носачи	C 35/45, XC3, , XF1, PV-II	B500B	4.0
Ивични венци и пешачке стазе	C 40/50, XC4, XD3, XF4, PV-II	B500B	4.5
Лежишне греде и квадери	C 30/37, XC3, , XF1, PV-I	B500B	4.0
АБ стубови	C 30/37, XC4, , XF1, PV-I	B500B	5.0
АБ потпорни зидови	C 30/37, XC4, , XF1, PV-I	B500B	5.0
Шипови	C 30/37, XC2, PV-I	B500B	мин 7.5cm
Наглавне греде	C 30/37, XC2, PV-I	B500B	5.0
Прелазна плоча	C 30/37, XC2, PV-I	B500B	5.0
Подбетон	C 12/15, X0		

MATERIAL PROPERTIES

Component	Бетон	Reinforcement	Clear cover
Prestressed girders	C 45/55, XC4, , XF1, PV-II	B500B	4.0
Deck slab and diaphragms	C 35/45, XC3, , XF1, PV-II	B500B	4.0
Edge beams and sidewalks	C 40/50, XC4, XD3, XF4, PV-II	B500B	4.5
Pier caps and bearing pedestals	C 30/37, XC3, , XF1, PV-I	B500B	4.0
Pier columns and abutments	C 30/37, XC4, , XF1, PV-I	B500B	5.0
Retaining walls	C 30/37, XC4, , XF1, PV-I	B500B	5.0
Piles	C 30/37, XC2, PV-I	B500B	min 7.5cm
Pile caps	C 30/37, XC2, PV-I	B500B	5.0
Approach slabs	C 30/37, XC2, PV-I	B500B	5.0
Lean concrete	C 12/15, X0		

Број/Number	Датум / Date	Опис / Description
03		
02		
01		

Ревизиони блок: / Revision block:

China Railway Design Corporation Serbia
Ogranak Beograd
Косте Рацина 16б; 11000 Београд; Србија

Организациона јединица: ГРАЂЕВИНАРСТВО И САОБРАЋАЈ
Organization unit: DEPARTMENT OF CIVIL AND TRANSPORTATION

Одговорни пројектант:
Responsible designer:
Зоран Луковић, дипл.грађ.инж
лиценца број:/ license No.: 310 3032 03

Сарадници: / Associates:
Предраг Бакић, дипл.грађ.инж.
Душко Бобера, дипл.грађ.инж.
Ивана Тадић, дипл.грађ.инж.
Мирослав Радњић, дипл.грађ.инж.
Иван Мићовић, дипл.грађ.инж.

Унутрашња контрола: / Internal control:
Ruan Lidong. Bachelor & Tian Shanpo. Bachelor

Главни пројектант: / Chief designer:
др Љиљана Милић Марковић, дипл.грађ.инж.

Руководилац организационе јединице:
Manager of organization unit:
др Љиљана Милић Марковић, дипл.грађ.инж.

Инвеститор пројекта: / Investor:
" ИНФРАСТРУКТУРА ЖЕЛЕЗНИЦЕ СРБИЈЕ " А.Д.
/ " INFRASTRUCTURE RAILWAYS OF SERBIA " JSC
Немањина 6/IV, Београд / Nemanjina Street 6/IV, Belgrade

Наручилац пројекта: / Employer:
中国铁路国际有限公司 CHINA RAILWAY International Co, Ltd.
China Railway International Corporation Ltd.
No.10 Fuxing Road,Haidian District,Beijing
P.R China, 100844
China Communication Construction Company Ltd. (CCCC)
No.85 Deshengmenwai Street,Xicheng District,Beijing
P.R China, 100088

Објекат: /Structure:
ПРУГА БЕОГРАД - СУБОТИЦА - ДРЖАВНА ГРАНИЦА (КЕЛЕБИЈА)
ДЕОНИЦА ПРУГЕ НОВИ САД - СУБОТИЦА - ДРЖАВНА ГРАНИЦА (КЕЛЕБИЈА)
BELGRADE - SUBOTICA - STATE BORDER (KELEBIA) RAILWAY LINE
SECTION : NOVI SAD - SUBOTICA - STATE BORDER (KELEBIA)

Део пројекта:/ Part of Design:
ПРОЈЕКАТ КОНСТРУКЦИЈА / DESIGN OF CONSTRUCTION

2/1.1.12 Пројекат надвожњака на км 95+739,56
2/1.1.12 Overpass at km 95+739,56

Цртеж:/ Drawing: КАРАКТЕРИСТИЧНИ ПОПРЕЧНИ ПРЕСЕК / TYPICAL CROSS SECTION

Размера: Scale: 1:50

Врста тех. док.: Type of tech. docum.: ПГД / DCP

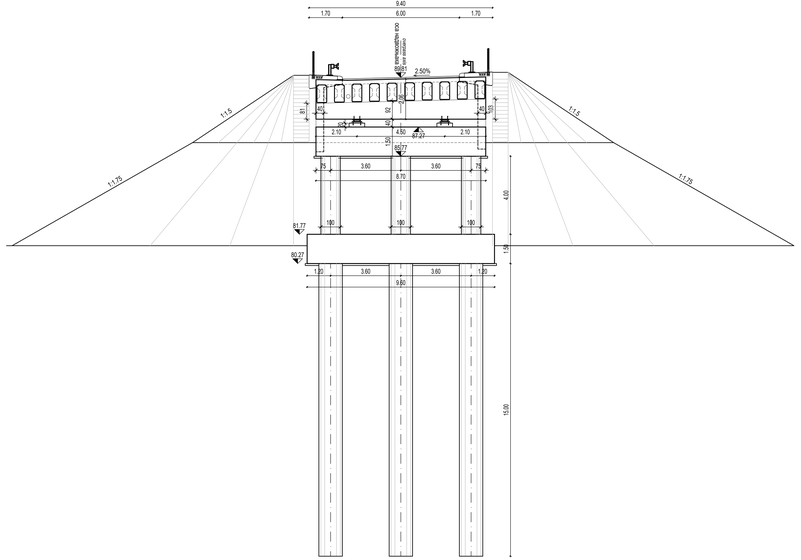
датум:/date: 04.2021.

Цртеж бр./Drawing No.: 2020-001-ГС-2/1.1.12.7.Ц02.

ПОПРЕЧНИ ПРЕСЕК НА МЕСТУ СТУБА С1, С8

CROSS SECTIONS AT PIER S1, S8

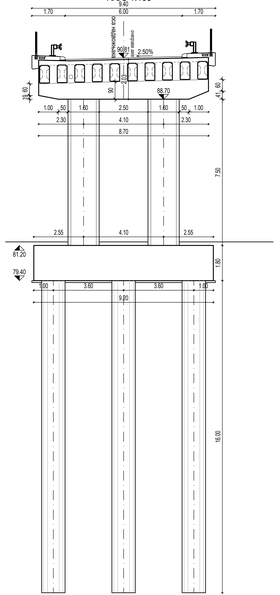
R/SC 1:100



ПОПРЕЧНИ ПРЕСЕК НА МЕСТУ СТУБА С2, С7

CROSS SECTIONS AT PIER S2, S7

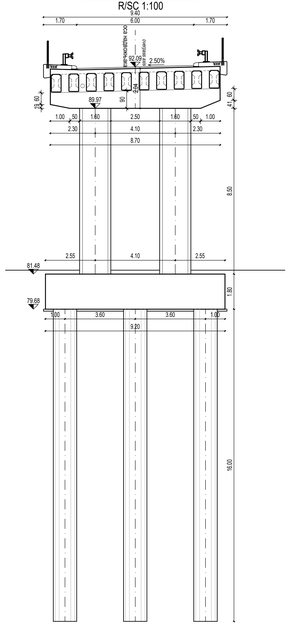
R/SC 1:100



ПОПРЕЧНИ ПРЕСЕК НА МЕСТУ СТУБА С3, С6

CROSS SECTIONS AT PIER S3, S6

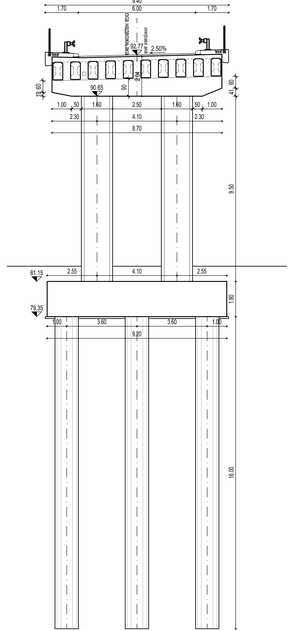
R/SC 1:100



ПОПРЕЧНИ ПРЕСЕК НА МЕСТУ СТУБА С4, С5

CROSS SECTIONS AT PIER S4, S5

R/SC 1:100



КАРАКТЕРИСТИКЕ МАТЕРИЈАЛА

Елемент	Бетон	Арматура	Заштитни слој
Претходно напрегнути носачи	C 45/55, XC4,	,XF1, PV-II	B500B	4,0
Коловозна плоча и попр. носачи	C 35/45, XC3,	,XF1, PV-II	B500B	4,0
Ивични венци и пешачке стазе	C 40/50, XC4, XD3, XF4, PV-II	B500B	4,5
Лежишне греде и квадери	C 30/37, XC3,	,XF1, PV-I	B500B	4,0
АБ-стубови	C 30/37, XC4,	,XF1, PV-I	B500B	5,0
АБ потпорни зидови	C 30/37, XC4,	,XF1, PV-I	B500B	5,0
Шипови	C 30/37, XC2,	PV-I	B500B	мин 7,5cm
Наглавне греде	C 30/37, XC2,	PV-I	B500B	5,0
Преклапна плоча	C 30/37, XC2,	PV-I	B500B	5,0
Подбетон	C 12/15, X0			

MATERIAL PROPERTIES

Component	Бетон	Reinforcement	Clear cover
Prestressed girders	C 45/55, XC4,	,XF1, PV-II	B500B	4,0
Deck slab and diaphragms	C 35/45, XC3,	,XF1, PV-II	B500B	4,0
Edge beams and sidewalks	C 40/50, XC4, XD3, XF4, PV-II	B500B	4,5
Pier caps and bearing pedestals	C 30/37, XC3,	,XF1, PV-I	B500B	4,0
Pier columns and abutments	C 30/37, XC4,	,XF1, PV-I	B500B	5,0
Retaining walls	C 30/37, XC4,	,XF1, PV-I	B500B	5,0
Piles	C 30/37, XC2,	PV-I	B500B	min 7.5cm
Pile caps	C 30/37, XC2,	PV-I	B500B	5,0
Approach slabs	C 30/37, XC2,	PV-I	B500B	5,0
Lean concrete	C 12/15, X0			

Број/Number	Датум / Date	Опис / Description
03		
02		
01		

Ревизиони блок: / Revision block:

China Railway Design Corporation Serbia Ogranak Beograd
Косте Рацина 16б; 11000 Београд; Србија

Организациона јединица: ГРАЂЕВИНАРСТВО И САОБРАЋАЈ
Organization unit: DEPARTMENT OF CIVIL AND TRANSPORTATION

Одговорни пројектант: / Responsible designer:
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China Railway Design Corporation Serbia Ltd. Ogranak Beograd
Kosте Racina 16b, 11000 Belgrade, Serbia

Објекат / Structure:
ПРЕКОГРАНИЧНА ДЕОНИЦА - ДРЖАВНА ГРАНИЦА (КЕЛЕБИЈА) - ДЕОНИЦА ПРУГЕ НОВИ САД - СУБОТИЦА - ДРЖАВНА ГРАНИЦА (КЕЛЕБИЈА)
BELGRADE - SUBOTICA - STATE BORDER (KELEBIJA) RAILWAY LINE
SECTION - NOVI SAD - SUBOTICA - STATE BORDER (KELEBIJA)

Део пројекта / Part of Design:
ПРОЈЕКАТ КОНСТРУКЦИЈА / DESIGN OF CONSTRUCTION

21.1.12 Пројект надвожњака на км 99+738,56
21.1.12 Overpass at km 99+738,56

Унутрашња контрола / Internal control:
Ruan Lidong, Bachelor & Tan Shanpo, Bachelor

Главни пројектант: / Chief designer:
др Љиљана Милић Марковић, дипл.грађ.инж.

Руководилац организационе јединице: / Manager of organization unit:
др Љиљана Милић Марковић, дипл.грађ.инж.

Цртеж: / Drawing:
ПОПРЕЧНИ ПРЕСЕЦИ
CROSS SECTION

Размера: / Scale:
1:100

Врста тех. док.: / Type of tech. docum.:
ПГД / DCP

Датум / Date:
04.2021

Цртеж бр. / Drawing No.:
2020-001-IC-211.1.12.7.Ц03.